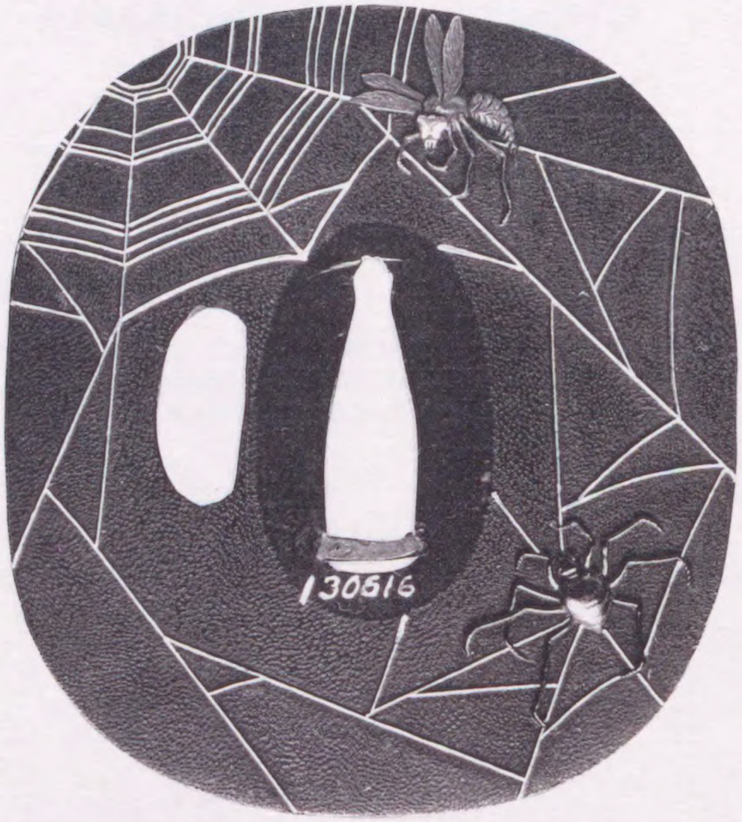
The Field Museum
Collections and Research 1996



Center for Evolutionary and Environmental Biology
Center for Cultural Understanding and Change

Academic Affairs

THE FIELD MUSEUM

ACADEMIC AFFAIRS

COLLECTIONS AND RESEARCH

FEBRUARY 1996

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CONTENTS

Introduction to Report on the Collections 4
Field Museum Mission Statement 5
Introduction to The Field Museum 7
Table of Organization 10
Academic Affairs Staff List, February 1996 11
Center for Evolutionary and Environmental Biology Programmatic Themes 15
    Systematics—The Science of Past and Present Biological Diversity 15
    Conservation Biology 16
    Biodiversity Information Resources 17
    Geochronology Research 18
    Global Change Research 18
    Developmental Biology and Biotechnology Research 20
Center for Cultural Understanding and Change Programmatic Themes 21
    Explaining the Rise of Complex Societies 21
    Cultural Diversity, Similarity, Change and Stability 22
    The Interface Between Humans and the Environment 23
    Understanding Patterns of Human Conflict 24
Office of Environmental and Conservation Programs 25
Department of Anthropology 27
    History 27
    Research 29
    Collections 31
Department of Botany 35
    History 35
    Research 35
    Collections 36
Department of Geology 42
    History 42
    Research 42
    Collections 44
Department of Zoology 52
    History 52
    Research 54
    Collections 54

CONTENTS (continued)

Department of Information Services 68
    Collections of The Field Museum Library 68
    Photographic Collections 72
    Collections Computerization 76
Profiles of Researchers 84

Introduction to Collections and Research at The Field Museum

This report is the first attempt in almost a decade, and the most comprehensive attempt ever, to summarize, in a single document, the scope and strengths of the collections and research programs at The Field Museum. Many of the data relating to collections have been compiled previously for grant submissions or departmental summaries, but they have never been brought together to provide an overview of the more than 20 million specimens and artifacts that provide the foundation for the Field Museum's programs in research and public learning.

This report provides a preliminary summary of the history, strengths and current status of The Field Museum's collections, and places these together with summaries of the scholarly interests of The Field Museum's resident researchers. Internally, this document has already provided valuable data for planning new initiatives in research and collections. Externally, we intend that this compilation will be improved, updated and then disseminated broadly to increase knowledge of the expertise and collections available at The Field Museum.

Peter R. Crane

A. Watson Armour III Curator

Vice President, Academic Affairs and Director

Front Cover: Tsuba (guard) for a Japanese sword. 18th century. Made of black-patinated shakudo, a copper alloy, with gold inlay. In the style of the Nara school, but without a maker's signature. The soft copper plugs above and below the triangular opening served to fit the tsuba tightly on the blade. Gift of Dr. Frank W. Gunsaulus, 1916. Field Museum Anthropology Catalog Number 130616. (Photograph by John Weinstein, neg. #:112945).

THE FIELD MUSEUM - MISSION STATEMENT

Preamble: **Serving The Public As Educator**

The Field Museum is an educational institution concerned with the diversity and relationships in nature and among cultures. It provides collection-based research and learning for greater public understanding and appreciation of the world in which we live. Its collections, public learning programs, and research are inseparably linked to serve a diverse public of varied ages, backgrounds and knowledge.

Subject Matter Focus: **Living Together On The Living Earth**

Combining the fields of Anthropology, Botany, Geology, Paleontology and Zoology, the Museum uses an interdisciplinary approach to increasing knowledge about the past, present and future of the physical earth, its plants, animals, people, and their cultures. In doing so, it seeks to uncover the extent and character of biological and cultural diversity, similarities and interdependencies so that we may better understand, respect, and celebrate nature and other people.

Collections: **World-Wide Knowledge Database**

The Museum holds encyclopedic collections of biological and geological specimens and cultural objects as the data needed to understand the nature of — and conditions affecting — environmental and cultural change. In support of these collections, we also hold significant collections of books, periodicals, photographs, illustrations, computer data, archival and instructional material. Like a great research library, our collections of more than 20 million items are a crucial part of the world's knowledge database for the sciences, humanities and the arts. The Museum holds the collections in trust for future generations. Over time, new knowledge is gleaned from the collections. Accordingly, the Museum must manage the collections to provide for both long-term conservation and access and make strategic additions to the collections pursuant to clearly defined objectives. In discharging its collection trusteeship, the Museum recognizes the special relationship it has with the people whose cultures and habitats are represented in the collections. We will nurture these special relationships so together we can enhance greater understanding of cultural traditions and environmental surroundings for the benefit of all humankind.

Public Learning: **Offering Greater Understanding About Environments And People**

Unlike schooling, learning in a museum is self-motivated, self-directed, and can be lifelong. Unlike print and electronic media, information is communicated primarily through real, tangible objects. Museum learning usually takes place during leisure time and without the direction of a teacher. The exhibit is the principal avenue of learning. Exhibits are augmented by people-mediated programs and a visitor-oriented museum-wide staff which reaches out to assist all visitors. Services to schools and communities extend the museum experience to people beyond our walls. To stimulate a public sense of inquiry, curiosity and delight, our exhibits and programs are not only informative, but also entertaining and inspiring. We focus on critical environmental and cultural issues which are engaging and relevant to the public's daily lives and civic responsibilities. We must be a vital educational and recreational destination for both our local and world-wide communities.

Research: **Explaining The Patterns And Processes That Shape The Living Earth**

The Museum maintains a vital program of basic research that continually stimulates active and pioneering uses of the collections. Seeking new knowledge and deriving new syntheses about the dynamic physical, biological and cultural patterns and processes that shape the living earth, Museum research centers on anthropology and the natural sciences of evolutionary and environmental biology and geology. All of the research programs are focused on the interrelationships among the earth, its environments, life and cultures and how they change over time. Our research methods use advanced technologies and encourage an interdisciplinary approach which combines the Museum's disciplinary breadth and small research staff into a uniquely imaginative and focused whole. Our basic research has direct linkages to research about conservational, ecological, biomedical and multicultural issues. The Museum and its staff communicate our research findings and ideas about the history of the planet by means of scholarly and general papers, oral presentations to scientific and public audiences, public exhibits and other learning programs.

Publics: **Reaching Out**

Field Museum serves diverse publics ranging from children, adults and families to the national and international research community. We reach out to our diverse publics and their changing educational needs. We have a special responsibility to reach out to the people of Chicago, neighboring communities and the State of Illinois. Our visitors should reflect the cultural, educational and economic diversity of the Chicago metropolitan area. We must work collaboratively and sensitively with the people in our locality, country and world whose cultures and habitats are represented in our collections, research and public programs. In reaching out, the Museum must build on its long-standing tradition of "outreach" which takes its resources and programs to schools, parks, and communities.

Linkages: **Working With Others**

The Field Museum is a unique educational institution in a network of nearby and international educational institutions. We must work closely with neighboring schools, colleges, universities and research institutions to strengthen the quality and effectiveness of our collection-based research and public learning. We need to collaborate with other museums, environmental, cultural and recreational groups and organizations to fulfill our educational mission. The Museum has an obligation to seek out and collaborate with researchers and teachers who reside in the areas from which our collections come.

Center Of Understanding And Mutual Respect: **Listening To Each Other**

The Museum subject matter directly relates to the great issues of the present and future: environmental and cultural diversity and their interrelationships. There are differing scholarly and public viewpoints on these concerns. While the Museum does not take institutional positions on these issues, it must serve as a center of free inquiry, a marketplace for multiple points of view on these matters. In doing so it serves as a forum where relevant controversy can be aired. In this way the Museum can be a "door in the wall" of our differences and inspire greater knowledge, understanding and respect for our varied natural environments and cultural heritages.

Public Service: **Our Commitment**

We — the trustees, staff and volunteers of The Field Museum — are dedicated to public service. Together and individually we share a commitment to provide services and opportunities to our many publics. As an institution devoted to the study of diversity and relationships, we will practice diversity in our public contacts and staffing. We will nurture an environment of mutual respect which will extend to the public we serve. We will act ethically in our relations with the public and with each other. Collectively and individually we are committed to the mission of the Museum and our public service responsibilities.

INTRODUCTION TO THE FIELD MUSEUM

Founding—The Field Museum was incorporated in the State of Illinois on September 16, 1893 as the Columbian Museum of Chicago with its purpose the "accumulation and dissemination of knowledge, and the preservation and exhibition of objects illustrating art, archaeology, science and history." In 1905, the Museum's name was changed to Field Museum of Natural History to honor the Museum's first major benefactor, Marshall Field, and to better reflect its focus on the natural sciences. In 1921 the Museum moved from its original location in Jackson Park to its present site on Chicago Park District property near downtown where it is part of a lakefront museum campus that includes the John G. Shedd Aquarium and the Adler Planetarium. These three institutions are regarded as among the finest of their kind in the world and together attract more visits annually than any comparable site in Chicago.

Collections—The Field Museum was founded to house the biological and anthropological collections assembled for the World's Columbian Exposition of 1893. These objects form the core of the Museum's collections which have grown through world-wide expeditions, exchange, purchase, and gifts to more than twenty million specimens. The collections form the foundation of the Museum's exhibition, research and education programs, which are further informed by a world-class natural history library of more than 250,000 volumes.

Public Learning—As an educational institution the Field Museum offers multiple opportunities for both informal and more structured public learning. Exhibits remain the primary means of informal education, but throughout its history the Museum has supplemented this approach with innovative educational programs. The Harris Loan Program, for example, begun in 1912, provides educational outreach to children, bringing artifacts, specimens, audiovisual materials, and activity kits to Chicago area schools. The Department of Education, begun in 1922, offers a changing program of classes, lectures, field trips and special events, such as museum overnights, for families, adults and children. Professional symposia and lectures, such as the annual Spring Systematics Symposium, presents the latest scientific results to the international scientific community as well as the public at large.

Research—The Museum's curatorial and scientific staff in the departments of Anthropology, Biology, Geology, and Zoology conducts basic research in the fields of systematic biology and anthropology, and also has responsibility for collections management, and collaboration in public programs with the Departments of Education and Exhibits. Since its founding the Field Museum has been an international leader in evolutionary biology and paleontology, and archaeology and ethnography, and has long maintained close links, including joint teaching, students, seminars, with local universities - particularly the University of Chicago and the University of Illinois at Chicago.

Audience and Attendance—The Field Museum serves a large and diverse public including school children, teachers, families, and adults - casual visitors, tourists, students, collectors, amateur scholars and the national and international scientific community. Since 1927, more than one million people annually have visited the Field Museum from Chicago, Illinois, the nation, and abroad. In 1995 total attendance reached 1,263,453 visitors, including 268,400 children in school groups. Most visitors to the Museum were residents of Chicago and the surrounding suburbs: 26.9 % from the City of Chicago, 24.9 % from the surrounding suburbs including Cook, Dupage, Will, Kane, Lake and McHenry Counties, 5.7 % from other Illinois counties, 41.8 % from other states, and 0.7 % international visitors. In 1995, the collections were made available to 2,255 scientific visitors, and 44,145 specimens were loaned to other institutions for research and exhibits.

Serving Chicago—Visits to the Museum are free on Wednesday, and all Chicago school groups, plus all Chicago Park District and other community groups are admitted without charge. In 1995 the Museum distributed c. 52,000 free family passes to Chicago children, including c. 26,000 passes distributed through Chicago Park District summer camps. The Museum also provides free use of facilities for meetings of teachers and staff of the Chicago parks and schools. In 1995, 314,617 Chicago residents visited the Museum. Approximately 60 % entered without charge, including 99,884 Chicago students with school groups.

School Programs and Outreach—School tours remain a major part of Field Museum programs. In 1995, the Museum provided training programs for 988 teachers. The Museum's Community Outreach Program works in city neighborhoods to develop links to community agencies, such as boys' and girls clubs', Y's, branch libraries, preschool and after school day care centers, senior centers, settlement houses, day camps, recreation centers, playgrounds and park programs. In 1995 the Museum collaborated with the Chicago Park District Park Partners Program to present sixty programs at park field houses, and with the Chicago Housing Authority Museum Consortium to present programs in city elementary schools, and to bring more than four hundred children, adults and seniors from eight Chicago Housing Authority sites to the Museum. The Museum's Educational Loan Program sent 5,895 materials and mini-exhibits to 2,559 elementary educators. The Museum is working to expand the number of women and minorities in the sciences through several internal and externally funded internship programs.

Schedule for the Public —The Field Museum is open from 9 a.m. to 5 p.m. daily; closed New Year's Day, Thanksgiving and Christmas. Admission is free for Illinois school groups, teachers, museum members, the active military, and, pursuant to Illinois law, for all visitors on Wednesdays. **The Harris Educational Loan Center** is open six days per week to accommodate community educators. The **Rice Wildlife Research Station**, **Webber Resource Center of Native Peoples of the Americas**, and **Africa Resource Center** are open daily, 10 a.m. to 4:30 p.m. The Museum Library is open to the public Monday to Friday, 10 a.m. to 4:30 p.m.

1986 Strategic Plan—In 1985 and 1986, looking to its centennial in 1993 and 1994, the Museum developed a strategic plan - Centennial Directions - that highlighted the dual mission of the Museum - as a research institute and public museum - and recognized the clear need for institutional support services to carry out both missions. As a research institute, the Museum looked to maintain and build its collections, while making them more accessible both for research and public education. It sought to strengthen the Museum's capacity to conduct collection-based research of the highest international caliber, and increase curatorial participation in graduate and undergraduate education. In the public museum, the strategic plan called for an innovative new approach to exhibits that encompassed informal interactive exhibits, major thematic exhibits, and resource centers for in-depth study. This exhibit program paralleled a major marketing initiative as well as expansion of the Museum's school and community outreach efforts. Centennial Directions also sought to increase support for the Museum through targeted constituency development, expanded earned income from increased visitation, and improved food services, visitor services, Museum stores, and special events.

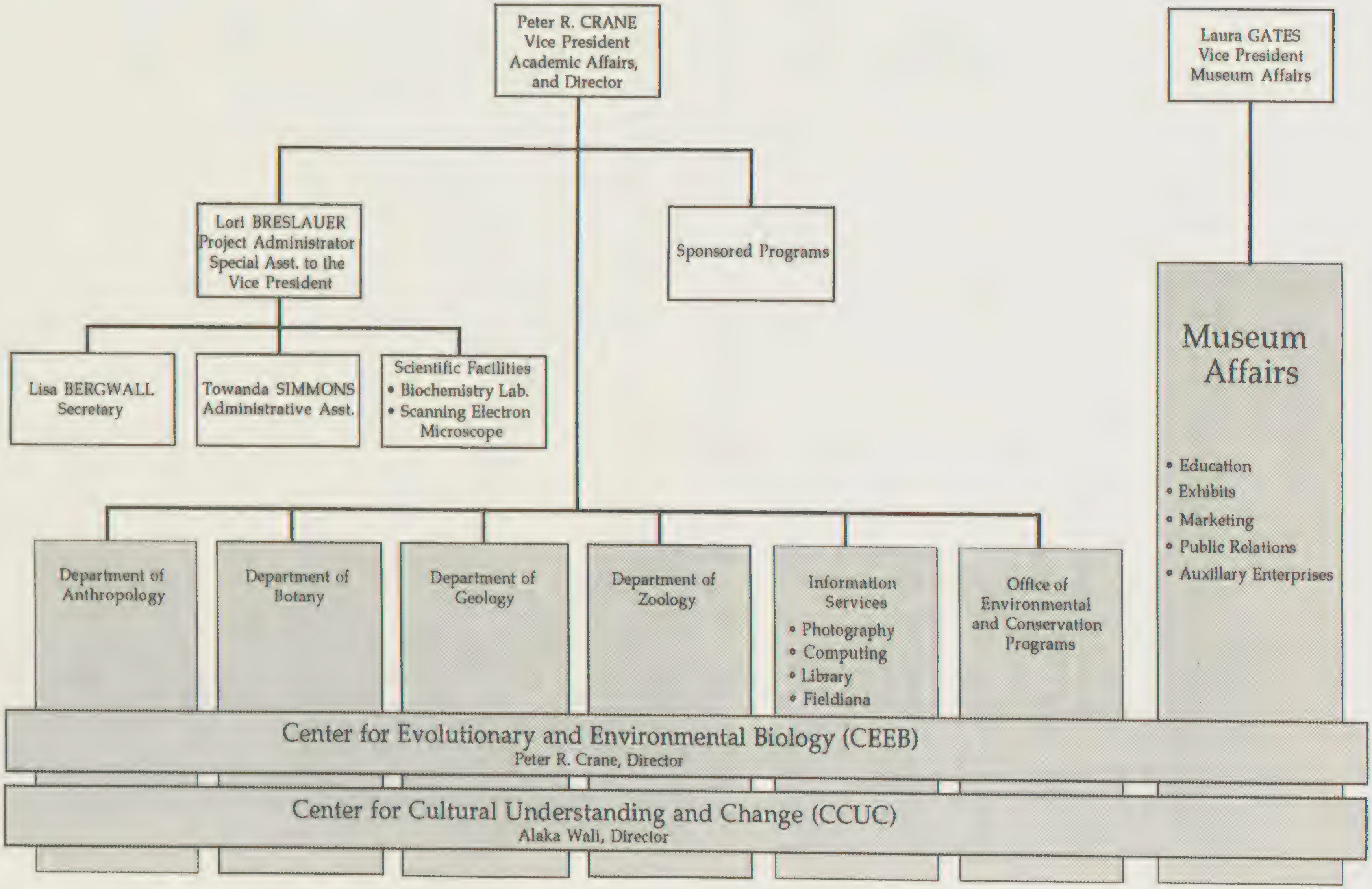
Outcomes of the 1986 Strategic Plan—Resulting from Centennial Directions, the Museum adopted a new organizational structure with four administrative units: Collections and Research, Public Programs, Development, and Finance and Museum Services. A three-year capital campaign raised $43 million to provide for the Museum's endowment, develop new exhibits and programs, strengthen research capacity, provide necessary building repairs, improve collection facilities, and contribute to operating support. By the end of 1994, the Museum had renewed 139,000 square feet of exhibit space, including several major new exhibits, such as **Egypt**, **Traveling the Pacific**, **Africa**, **Life over Time**, **Messages from the Wilderness**, and **What is an Animal?** Three resource centers were established for in-depth study. A variety of new outreach programs were implemented to serve Chicago's neighborhoods, parks and schools. A Visitor Services Program was established to respond more effectively to visitor needs. 56,000 square feet of exhibit space was converted to provide much-needed collections, research and storage space. A new collections facility (28,000 square feet with capacity for compactorization) was constructed. Additions to the research infrastructure included a new scanning electron microscope, a new computing center, biochemistry laboratories, functional morphology laboratory, and paleomagnetics laboratory. Strengthened scientific programs were reflected in increased research productivity and expanded support from the National Science Foundation and other agencies for collections and research. Collaborative research and education programs with area universities and other institutions were expanded. Visitation and earned income were both increased, and the Museum maintained a deficit-free budget.

1992 Strategic Plan—With the 1986 Strategic Plan approaching completion, in 1992 the Museum engaged in a renewed institution-wide program of strategic planning to set a course that would sustain the Museum into the next century. The 1992 Strategic Plan recognizes that to ensure an appropriate and efficient interdisciplinary and integrated approach, the Museum must operate horizontally across traditional and functional boundaries, while maintaining strengths in its areas of specialty. Specifically, the plan calls for: shared concentration on producing superior public service; integrated approaches to learning for the Museum's diverse public; a unifying intellectual theme for all Museum programs; strong curatorial presence in collections, research and public learning; effective processes to provide interdisciplinary programs (among anthropology, geology and biology - within biology - among collections, research and public programs); and mutual respect for the contributions of staff in all areas of the Museum. These fundamental principles are embodied in a new Mission Statement that articulates a vision of a unique institution of public learning concerned with diversity and interconnections, both in nature and among cultures. The initial stages of the 1992 Strategic Plan required changes in organizational structure and procedures, and especially the implementation of a matrix approach.

Implementing the 1992 Strategic Plan—Two interdisciplinary centers - the **Center for Evolutionary and Environmental Biology** and the **Center for Cultural Understanding and Change** - have been established to provide the unifying curriculum and intellectual rallying points for all Museum programs. These centers are not administrative units but cut across all Museum departments to articulate and facilitate a museum-wide approach to basic environmental and cultural issues that confront local and worldwide communities. **The Collections Council** is charged with defining the nature of the Museum's collections and provides a forum for an integrated, museum-wide approach to collection-related issues. **The Science Advisory Council** is charged with articulating the significance of the Museum's research to national priorities (e.g., global warming, biodiversity, conservation, multicultural issues), expanding the Museum's research output and promoting the use of the collections. **The Public Learning Council** is designed to provide an integrated forum for the development of the Museum's public learning agenda that makes effective use of financial and human resources and meets the need to generate increased revenue and produce timely and changing educational exhibits. **The Public Services Matrix** is charged to address a variety of outstanding issues in Visitor Services, Security, Housekeeping and A/V, including improving maintenance schedules and off-site staff training in customer service techniques. It also works to maintain a close working relationship with the Chicago Police Department, the Chicago Fire Department and the Chicago Park District.

A Vision for the Future—An institution is only as strong as its vision of the future and strong vision is the foundation for developing strategies and priorities that guide day-to-day decisions. As The Field Museum enters its second century, the concept of interconnectedness is reshaping society's approach to cultural and environmental issues. To position the Museum for a leadership role in addressing these issues–arguably the central issues of our time–The Field Museum's Strategic Plan calls for us to embrace a new vision and change the way we approach our mission. We are adopting a vision of "connecting" and emphasizing "total habitat" in everything from cultural understanding to endangered species to museum operations. Our vision is of an institution concerned with the interconnections in nature and among cultures. Our vision is of an institution that connects internally across departmental lines to make wise use of collections and human and financial resources. Finally, our vision is of an institution that establishes creative, more vital links with funding sources to gain the financial support required to support its strategy.

ORGANIZATIONAL CHART



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(as of February 19, 1996)

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Department of Information Services

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Lance Grande, Ph.D	Chair, Scholarship Committee
Elaine Zeiger, B. Music	Secretary, Scholarship Committee

The Field Museum, Chicago
Center for Evolutionary and Environmental Biology

PROGRAM THEMES

SYSTEMATICS - THE SCIENCE OF PAST AND PRESENT BIOLOGICAL DIVERSITY

What is Systematics?—Systematics is both the oldest and the most general of all biological subdisciplines. It is fundamentally synthetic, integrating information from all other areas of biology to understand the relationships among living and fossil organisms. In return it provides a comparative framework for biological research — a map of past and present biodiversity — and a standardized reference system of names that is essential for communication throughout biology. Without systematics all comparative biological or biomedical studies would be scientifically suspect, and communication in biology (and its attendant applied disciplines of agriculture, horticulture and medicine) would be in chaos.

Current Status of Systematics—Systematics is a dynamic science dedicated to exploring the patterns and processes underlying similarities and differences among organisms. Because scientists must always accurately specify the identity of their study organisms, systematics has always been one of the most pervasive of all branches of biology, but in the last decade, the discipline has undergone a striking renaissance initiated by a theoretical and methodological revolution. This revolution has substantially improved its rigor, and has dealt with several significant philosophical issues that had formerly blocked progress. In parallel with these advances, there has been the development of increasingly sophisticated computer software for rapid numerical analyses of large or complex data sets, and developments in molecular biology that allow amplification and sequencing of RNA and DNA across a variety of organisms. Taken together, these advances have improved the integration of systematics with modern evolutionary biology and ecology, have attracted a new generation of scholars into the field, and have reoriented the perception of systematics within biology as a whole. Modern systematists view the world's biotic diversity as a single genealogy by which all species, living and extinct, are interconnected. It is the job of the systematist to reconstruct that pattern of relationship—the phylogeny—and this knowledge provides the foundation upon which much of biology is built. The demand for systematic expertise is now greater than at any time in the last 50 years. Not only are systematists in the front-line of crucial environmental concerns, but the schism between molecular and organismal biology is closing rapidly as scientists from both areas come together to more completely explore the basis of biological diversity.

Systematic Research at The Field Museum—Throughout Field Museum's history, the scientific staff has been actively engaged in systematic research and the institution has maintained the collections which make such work possible, both nationally and internationally. The Field Museum is recognized internationally as a leader in the theory of systematic biology, and has world-class systematic biologists working on amphibians, birds, bryozoans, cryptogams, fishes, flowering plants, fungi, insects, mammals, marine snails, mites, octopods, and reptiles. The organisms studied by these researchers span the globe geographically and the last billion years temporally. Research efforts in systematics are supported by Field Museum's extensive collections, library, scanning electron microscope facility, computing center, biochemistry laboratories, histology laboratory, functional morphology laboratory and paleomagnetics laboratory. The needs of students at all levels are served through active training programs with area universities and schools. Research in systematics is basic to the work of almost all curatorial faculty, as well as the numerous interdisciplinary programs in which they are engaged.

PROGRAM THEMES

CONSERVATION BIOLOGY

Unquestionably, one of the greatest environmental issues of the 20th Century concerns the rapid disappearance of species worldwide. Current rates of species extinction rival those of the most catastrophic episodes in Earth's four billion-year history. Species loss is particularly great in tropical regions and while tropical moist forests cover scarcely six percent of the world's land surface, they support about half of all plant and animal species. Many species remain undiscovered and undescribed, and we are ignorant of both their roles in natural communities and their potential uses (e.g., crops or pharmaceutical products). Fewer than 1500 scientists worldwide are trained and equipped to inventory tropical diversity. Currently, less than one percent of the world's fauna and flora is under scientific study.

For nearly a century, Field Museum's departments of Botany and Zoology have inventoried and described global tropical diversity. Encyclopedic collections, extensive libraries, a renowned community of scholars, and strong university ties have allowed the museum to assume a leading role in biodiversity issues. Traditionally, staff activities led to enormous collections and monographic treatises, such as the continuing series Flora of Costa Rica and Flora of Peru or the landmark volumes Living New World Monkeys (Platyrrhini), The Frogs of Sabah and the Flora of Guatemala. Increasingly, however, the activities of curators and other staff focus even more directly on conservation of biological diversity through rapid assessment programs, training courses and the production of rapid field guides.

The impact of Field Museum programs on conservation biology is immediate and extensive. Field Museum botanical and zoological collections document historical range changes and population trends; the collections are also used to locate future parks and reserves. Museum curators, often in multi-disciplinary collaboration, frequently produce the first inventory of species inhabiting tropical parks and are uniquely qualified to formulate species and habitat management recommendations. Museum scientists are also reshaping the conceptual framework of conservation biology, by broadening the scope of a discipline rooted in the temperate zone with hard-won data from tropical ecosystems. Ongoing research at Field Museum is extending the theoretical foundations of conservation biology, from a classical focus on how many species are present to include both species composition (which species are present) and evolutionary distinctiveness (how distinctive are species from forms found elsewhere). These studies help to predict how communities of organisms will change under different environmental pressures. At present, the National Science Foundation, National Geographic Society, Conservation International, Agency for International Development, and the MacArthur Foundation are all partners in this work.

The Field Museum, Chicago
Center for Evolutionary and Environmental Biology

PROGRAM THEMES

BIODIVERSITY INFORMATION RESOURCES

Computerization now pervades all aspects of modern science, and has had a revolutionary impact in the area of environmental and evolutionary biology. The development of high capacity, inexpensive computers and more sophisticated software has allowed for unprecedented electronic data capture, storage, analysis, and retrieval. Systematists have traditionally collected, analyzed, summarized, and communicated information using specimens as single-item samples of biodiversity. However, large collections themselves are also of great value to both scientists and society. In particular, as collection information is computerized, broader questions can be addressed, historical trends can be evaluated, and data can be shared between institutions.

Many of The Field Museum's 20 million specimens are already catalogued in computerized form. Our botanical, geological, and zoological databases include such data as hierarchical classification, geographic location, ecology, chemical composition and geologic age. Computer networking is rapidly expanding the availability of these information resources, which are becoming available to scientists from thousands of computers world-wide. Information from only one institution is typically inadequate to answer complex questions concerning global distribution patterns or changing species frequencies, thereby making retrieval of ever-growing electronic data from other institutions a necessity. Networking systems that allow access to museum collections and biological libraries throughout the world are now crucial to research and policy decisions in environmental biology. Researchers with network-connected computers routinely communicate through electronic mail and send data around the globe in minutes. Digitized color images of plants, animals, fossils, maps, and illustrations residing in remote sites will soon be available over networks and easily coupled with more traditional computer information. The development of geographical information systems will continue to integrate data from many disciplines into dynamic maps necessary to address research priorities such as the biodiversity crisis and global climate change. Over the last two decades, The Field Museum has moved ahead vigorously with collections computerization and continues to take the lead in the application of such databases to biological resource issues.

PROGRAM THEMES

GEOCHRONOLOGY RESEARCH

The accurate subdivision and calibration of geologic time (geochronology) is crucially important in geological exploration, and central to many areas of pure and applied research in modern geology and environmental biology. Traditionally, changes in the composition of fossil assemblages through time have been used to develop a relative chronology of the stratigraphic record (biostratigraphy). The rates of decay of radioactive isotopes in other rocks have then been used to provide a numerical calibration of "absolute" time (radiometric dating). However, the full potential of these techniques has been difficult to realize because the best biostratigraphic time scales have been developed in ancient ocean basins while the best radiometric dates come from rocks deposited on ancient land surfaces. In the last twenty years the development of magnetostratigraphy, using the history of reversals in the Earth's magnetic field to "tell time," has provided a means of fully integrating biostratigraphic, radiometric and other stratigraphic techniques, leading to major advances in establishing increasingly accurate and globally applicable geologic time scales.

For almost a century the world-class fossil collections at The Field Museum have been used extensively in defining and refining biostratigraphic standards. Current programs extend these historic strengths to integrate biostratigraphy, magnetostratigraphy, and radioisotopic dating. The recent construction of a new magnetically-shielded laboratory for studies in paleomagnetics has made The Field Museum an internationally recognized center for geochronology. Research currently under way using the paleomagnetics facilities is: i) providing more secure and accurate age assignments for fossil-bearing strata, ii) developing a refined globally applicable standard geologic time scale, iii) using geochronologic information to understand plate tectonics and the rate and timing of mountain building and basin formation (Rocky Mountain basins; Magdalena Basin, Colombia; Chilean Andes), and iv) reconstructing paleoenvironments in hydrocarbon-bearing sedimentary basins (western North America, Chile, Colombia). At present, the National Science Foundation, National Geographic Society and NASA are all partners in this work. In 1985 a Field Museum geologist and two co-workers developed a standard geologic time scale for the past 66 million years, which is being used by the Geological Society of America as the time scale for its Decade of North American Geology Project. Recent users of The Field Museum paleomagnetics facilities include students and faculty from the University of Chicago, Northwestern University, Rutgers University, University of North Carolina-Charlotte, Universidad Autonoma of Mexico City, Duke University, and the State University of New York at Stony Brook.

The Field Museum, Chicago
Center for Evolutionary and Environmental Biology

PROGRAM THEMES

GLOBAL CHANGE RESEARCH

The diverse issues encompassed by the term "global change" (e.g., "greenhouse effect," ozone depletion, deforestation, declining freshwater resources) are among the most pressing societal concerns at the close of the 20th Century. Scientific investigation of these problems requires implementation of large-scale, interdisciplinary research designed with the realization that hydrologic, sedimentological, climatic, and geochemical systems are all affected profoundly by spatial and temporal changes in the Earth's biota. A central element of this new holistic research agenda is to look to the geological record as the key to understanding the complex biotic and environmental interactions that drive global change. Thus, for the relatively recent past, examination of polar ice cores provides essential data on changing concentration of atmospheric carbon dioxide associated with advancing and retreating ice sheets, while knowledge of the more distant past provides insight into the interactions between the Earth's surface and climate systems, including the nature of the biosphere during former "greenhouse" intervals. These historical data also provide an opportunity to test the predictive power of the numerical climate models that are being developed based only on present-day information.

Paleontological and archaeological collections at The Field Museum are a major international resource for elucidating the history of plants, animals and cultures, providing baseline data from which the Earth's environmental history may be interpreted and hypotheses of future global change may be tested. For example, research under way at The Field Museum is using the paleobotanical record to decipher vegetational and climatic changes through a critical phase of Earth history between approximately 140—65 myr B.P. (the Cretaceous Period). This interval witnessed a major modernization of terrestrial ecosystems and was also characterized by rapid rates of sea floor spreading, high levels of atmospheric carbon dioxide, massive emplacement of flood basalts, and the evolutionary diversification of several modern groups of plants and animals. Mid-Cretaceous marine rocks are also estimated to be the source of approximately 70% of the world's oil reserves. Field Museum curators are using the extensive published record of pollen grains and spores to reconstruct the marked vegetational changes that occurred through this interval, including the origin and diversification of flowering plants, the rise of modern groups of ferns and conifers, and the extinction of ancient plant groups. With these patterns established, possible causal links to changes in Cretaceous global environments are now beginning to be addressed. In the more recent past, Field Museum scientists are studying the vegetational history of the tropics during the last Ice Age and are examining human-environment interactions in Amazonia over the past 12,000 years. The Amazonian project investigates the history of landscapes and biotic communities, the influence of habitat on human development, the human influence on habitat, and the implications of this knowledge for conservation and development.

PROGRAM THEMES

DEVELOPMENTAL BIOLOGY AND BIOTECHNOLOGY RESEARCH

Comparative studies of plant and animal development have moved to center stage of modern biology, and are fast becoming one of the most active fields of research on the evolution of biological diversity. Classical approaches to evolutionary biology, such as population studies, concentrate on the variability of traits and their genetic background, yet fail to account for the fact that it is not traits nor characters that are inherited, but the potential for their development during the ontogeny of each organism. This means that every evolutionary change is reflected by a change in the sequence of developmental events, just as every change of developmental pathways causes an evolutionary change in the population of reproducing organisms. Therefore, the comparative study of developmental pathways, and the inquiry into their underlying causes, holds important keys not only to our understanding of how organisms develop but also to our understanding of the phylogenetic past.

In zoology, developmental studies at The Field Museum include studies of skeleton formation in reptiles, in particular on the sequence and patterns of bone formation. These investigations apply histological techniques of whole mount imaging to embryos of all major reptile groups (turtles, crocodiles and lizards) and provide important insights into "ontogenetic repatterning"—the development of new structural patterns as cartilage is replaced by bone. Understanding of "ontogenetic repatterning" is crucial for the reconstruction of evolutionary relationships, but also provides the basis for a more detailed investigation of patterns of skeletal reduction in fossil and living reptiles. Preliminary evidence suggests an influence of temperature and moisture during incubation on ossification processes as well as the importance of habitat factors.

In botany, there is now great interest in genetically engineering plants to improve their resistance to disease, increase their tolerance to drought, and to improve their commercial attributes (e.g., larger flower size in horticulture, improved yield in agriculture). In the past, systematists have contributed to achieving these kinds of improvements through their role in plant breeding programs. This will continue but recent developments in biotechnology offer even greater possibilities for genetic engineering and these too require the input of systematic expertise. One recent project with an international biotechnology research group examines the evolution of specific chemicals (osmoprotectants) that impart increased resistance to arid or saline conditions. The ultimate objective is to identify the genes controlling the synthesis of these compounds with a view to their transfer to appropriate agriculturally significant species.

The Field Museum, Chicago
Center for Cultural Understanding and Change

PROGRAM THEMES

EXPLAINING THE RISE OF COMPLEX SOCIETIES

Human societies began to be complex when groups of early villages came to be linked by common political systems, integrated economies, and shared systems of belief. The first cities and states emerged between 4000 and 3000 BC. By AD 500, similar institutions were present in many parts of the world. Urbanization and centralization have continued to intensify up to the present, although these processes have often been interrupted as various peoples have experimented with balancing complexity with simplicity, centralization with decentralization, and order with freedom. Field Museum anthropologists are seeking to understand the whys and hows of this long-term pattern of development. Did complex societies arise mainly through the influence of neighboring societies or was the process independent? What roles did demography and the environment play? How important has technology been, in politics as well as economics? What has been the long-term effect of warfare? How much complexity is necessary and inevitable? Have successful civilizations ever existed with decentralized political systems but large populations and sophisticated economies?

Relevant current research projects include those of several curators: Chuimei Ho's and Bennet Bronson's surveys of early manufacturing and trading centers in East and Southeast Asia, Chapurukha Kusimba's excavations of early Swahili settlements in East Africa, Charles Stanish's investigation of ancient urban sites on Lake Titicaca in Peru and Bolivia, Jonathan Haas's and Winifred Creamer's studies of early historic period settlements in the Rio Grande Valley of New Mexico, and Anna Roosevelt's ongoing work on prehistoric complex societies in the Amazon Basin of Brazil. All of these projects involve time spans of many hundreds of years. Also, Alaka Wali is examining the impact of global economic integration on patterns of urban resource distribution. All this research should illuminate reasons for the rise, decline and change of complex societal patterns.

The Field Museum, Chicago
Center for Cultural Understanding and Change

PROGRAM THEMES

CULTURAL DIVERSITY, SIMILARITY, CHANGE AND STABILITY

Cultures tend to change rapidly in some ways and to be conservative in others. This may be why they are at once very diverse and strikingly similar. Studying cultural change and diversity is central to the interests of many anthropologists, including those who work in this museum. This is because anthropology has traditionally been concerned with not only the world's majority cultures but also its minorities: the thousands of groups who in numeric terms form altogether only a few percent of the global population but whose past and present cultures-- languages, arts, faiths, social systems-- constitute more than ninety-nine percent of those that have ever existed. In this sense, anthropologists are specialists in the variety of human experience: in the vast number of existing solutions, past and present, to such problems as earning a living, coexisting with the environment, relating to kin, striving for status, organizing society, creating beauty, and understanding the universe.

Anthropologists in a museum like ours, surrounded as they are by material from a great variety of cultures, are acutely aware of diversity. Further, because most of our anthropologists use archaeological techniques in their research, they often come face-to-face with the fact that cultures change irregularly over the long term, keeping certain traits and institutions while allowing others to "mutate" or be replaced. Why this happens is a crucial question. Those on our staff who are most involved in answering it include Curators Terrell and Welsch, whose ongoing New Guinea Research Project is aimed at investigating a situation where hundreds of languages are spoken within a small area, where economic links among the speakers of those languages have historically been close, and where there is every reason to think that cultural differences between groups have persisted for long periods of time. They are collaborating with biologists as well as with social scientists from Papua New Guinea in investigating the problem.

Among others who work on related problems are Curators Haas and Creamer, who are studying changes that occurred in the Pueblo Indian cultures at time of their first contact with the Spanish, and Curator Wali, whose research on gender roles in New York's Harlem offers new insights into the nature of cultural diversity in our own society. Perhaps the most intensive and practical of our current studies of cultural diversity is that being done collaboratively between our staff and representatives of many Native American tribes in the context of repatriation discussions which are being held under the provisions of NAGPRA, the Native American Graves Protection and Repatriation Act passed by Congress as national law three years ago. Contacts between Native Americans and the Anthropology Department as well as other parts of the Museum are now frequent, intensive and highly rewarding in terms of what we learn about the American Indian collections and about the concerns of members of a very important group of cultures.

PROGRAM THEMES

THE INTERFACE BETWEEN HUMANS AND THE ENVIRONMENT

A central concern of Anthropology has been the analysis of human interaction with the natural environment and the way that interaction has shaped both cultural systems and the environment itself. Early theories on human evolution posited a unilineal mode of progression from technologically simple to technologically complex societies. Later, as systematic scientific collection of data on cultural diversity and adaptive techniques increased, unilinear evolutionary theories gave way to more sophisticated hypotheses about the relationship between environment, technological innovation and human cultural change. Cultural ecology is today a vital branch of anthropology, uniting the four sub-disciplines--cultural, physical, archaeology and linguistics. Theoretical frameworks within cultural ecology are used to explore such issues as the relationship between distribution and availability of natural resources and patterns of social organization, the changing relationship between cultural groups and the environments they inhabit, the impact of environmental change on physical variation, the rise and fall of complex societies, and the impact of human resource use on global environmental change.

Anthropologists at The Field Museum integrate collections based research with active field research to investigate these issues in a number of sites. In South America, research by Stanish in the Andes and by Roosevelt in Amazonia has been examining the ancient cultures in these sites to determine the impact of settlement pattern, agriculture and horticulture on these ecosystems. In the Andes, impressive irrigation systems built by archaic states testify to human ability to manage water resources in semi-arid climates. In Amazonia, archaeological research reveals that agricultural chiefdoms with sophisticated pottery traditions existed indicating a higher density of population that nevertheless managed to use the fragile ecosystem sustainably. Meanwhile, in the urban United States, Wali's cultural ecology approach reveals the way in which the distribution of resources and spatial configuration of settlement patterns affect the unequal access to health care services and thus affect rates of mortality and morbidity in a human-built environment. Collections-based research by Terrell and Welsch with the A.B. Lewis Collection from the Sepik region of Papua New Guinea is providing clues to the reasons behind cultural diversity and the interplay between diversity and economic exchange of resources. Finally, with the establishment of the joint Ph.D. Program between The Field Museum and the Department of Anthropology/Geography at the University of Illinois at Chicago, there is an opportunity for further collaboration on these issues in the fast-growing field of cultural geography.

UNDERSTANDING PATTERNS OF HUMAN CONFLICT

Anthropology has long attempted to understand the origins and contemporary configurations of human conflict, both intra-group and inter-group. In studying conflict, anthropologists have examined factionalism, segmentation, lines of communal tension, inter-group hostility or prejudice and warfare. Anthropological research has focused on the social institutions, social relationships and cultural belief systems that regulate or shape patterns of conflict. For example, there is considerable debate about the causes of warfare prior to the emergence of the State. Some theorists contend that a combination of demographic, dietary and technological variables explain persistent patterns of warfare in non-state societies and that here warfare acts as a mechanism to regulate population. Others contest that explanation disputing whether or not warfare actually reached significant levels in pre-state societies. Much anthropological research also documents the mechanisms societies create to minimize conflict and avoid warfare. Studies of State-organized societies explore the emergence of ideological forms such as racism or sexism as means to justify stratification and the ensuing conflict that emerges.

Field Museum anthropologists through their research with collections and in the field have contributed significantly to the understanding of this issue. Research by Haas and Creamer in the Southwest United States on the Pueblo peoples, before, during and after contact with European colonists is revealing the dynamics of interaction between State-organized and Stateless societies, and the changing nature of conflict patterns. Research in New Guinea by Terrell and Welsch is documenting the long-term existence of patterns of "inherited friendships," outside of competitive exchange relationships which acted to unite far-flung Sepik communities into *interaction spheres*. Research in Asia by Bronson and Ho and in East Africa by Kusimba on long-distance trade relationships is illuminating hitherto unknown connections between complex societies and the impact of these connections on the cultural formations of these places as well as on patterns of conflict. Collections-based research by Bronson and Kusimba on the extensive material culture holdings in The Field Museum from Asia, Africa and Madagascar is contributing to this project.

OFFICE OF ENVIRONMENTAL AND CONSERVATION PROGRAMS

The Office of Environmental and Conservation Programs (ECP) was established in 1995 to focus, strengthen and expand Field Museum's research and education efforts in these interdisciplinary areas of biology. As one of the most visible manifestations of the Center for Evolutionary and Environmental Biology, ECP works to develop immediate and resourceful links between the powerful knowledge base at The Field Museum and the critical needs for informing conservation and management decisions at the local, national and international levels.

Director of Environmental and Conservation Programs, Debra Moskovits, previously worked as consultant and analyst for Conservation International, while also renovating the Museum's public animal and environment halls, coordinating extensive exhibit and education programs in conservation biology, ecology, zoology and evolution. Robin Foster and Douglas Stotz, renowned for their excellence in tropical field research (see Researchers' Reports), are Conservation Ecologists in botany and zoology respectively. Leading tropical field ornithologist Thomas Schulenberg (see Researchers' Reports) joined the Office as leader of the Rapid Assessment Programs (RAP) in the American Tropics. Schulenberg is the resident member of Conservation International's staff at the Field Museum.

The Office of Environmental and Conservation Programs works with the Field Museum scientists to transform the expertise of our staff and the storehouse of information in museum collections into quick, accessible tools for selecting priority sites and guiding priority action in conservation and other management decisions. For example, high-resolution photo-reduced copies of selected herbarium sheets can become instant field guides to the plants of critical areas in the American tropics where no manuals or tools exist for identifying the flora. Computer databases with information from our vast vertebrate collections allow us to generate quick answers to questions of critical conservation concern. ECP disseminates important findings at regional workshops and professional meetings, and in scientific journals and university presses. It also complements these traditional channels with faster methods (e.g., desktop publishing), so that significant information can become readily accessible to conservation planners and policy makers around the world.

In its first year, the Office of Environmental and Conservation Programs played a significant role at workshops concentrating in priority sites for conservation in the lowland rainforets of the American tropics, the Andean mountain ranges, and the Chicago metropolitan region. Also completed during this first year was "Neotropical Birds: Ecology and Conservation," a book to be released by the University of Chicago Press in 1996. Authors Stotz, Fitzpatrick, Parker and Moskovits amassed a large ecological database on all species of birds that occur from Mexico south to Tierra del Fuego, and then analyzed this information with specific focus on conservation. The book provides guidelines to illustrate how governments, conservation organizations, and wildlife managers can use ecological databases to anchor conservation strategies and land management decisions in sound biological reality.

Collections point to critical regions of conservation concern. Selection of specific sites within those regions must follow, through on-the-ground inventories. The Rapid Assessment Programs (RAP) provide first-cut assessments of the species richness, degree of uniqueness, and level of threat of biological communities in unknown sites of conservation concern. Launched by Conservation International (Washington, DC) in 1990, RAP assembles teams of leading field biologists -- primarily museum systematists and host-country scientists -- to provide rapid but careful and thorough biological inventories of remote regions. The information is quickly provided in reports for decision-makers and biologists in government and non-government organizations, to help design viable reserves and formulate plans for regional conservation. Through ECP, The Field Museum has undertaken a stronger role in RAP, and now coordinates the programs in the American tropics with Conservation International. The focus of RAP in 1995 was in Bolivia, with a major effort toward launching a new training program for in-country scientists (see New Training Initiatives).

The Field Museum and Conservation International also received a planning grant from the W. Alton Jones Foundation to expand on the tradition of RAP to maximize conservation impact and scientific rigor, and develop a new approach to aquatic conservation. The Aquatic Rapid Assessment Program (AquaRAP) will assess the conservation significance and status of key, freshwater aquatic ecosystems. The work will take place primarily in tropical areas, where habitat disturbance coupled with high species diversity and endemism threaten aquatic biodiversity. Barry Chernoff (Zoology) with the help of Debra Moskovits will direct the program and work in collaboration with leading scientists from international and local institutions. A primary goal of AquaRAP is to identify priority regions for policy and decision makers, and to make conservation recommendations that are locally appropriate and capable of being locally supported. A protocol working-meeting, with a core group of the leading ichthyologist from South America, was successfully convened by Chernoff at the Field Museum. The field test will take place in 1996 in the binational border area of Bolivia and Peru, in the upper Amazon basin.

DEPARTMENT OF ANTHROPOLOGY

Department of Anthropology: History[1]

The anthropological holdings of The Field Museum began with the Columbian Exposition. The first public appeal for extensive anthropological exhibits at the Exposition was made by the celebrated American anthropologist Frederic Ward Putnam, Curator of the Peabody Museum at Harvard, in a letter to the Chicago Tribune in May 31, 1890. Putnam passionately argued that the Exposition and future Museum would be a "perfect exhibition of the past and present peoples of America and thus make an important contribution to science . . . which will be the first bringing together on a grand scale of representatives of the peoples who were living on the continent when it was discovered by Columbus."

Putnam has been described by some as the "father" of American archaeology, and as the great "professionalizer" of the discipline. Putnam was not only Curator at the Peabody and in charge of the anthropology building and exhibit at the Exposition, but he helped found the Departments of Anthropology at Berkeley, the American Museum of Natural History, and ultimately the Anthropology Department at The Field Museum.

Putnam was chief of the Department of Ethnology at the Exposition and appointed Franz Boas, then a German immigrant and professor at Clark University, as his chief assistant and head of the section on physical anthropology. He also appointed one of his students at Harvard, George Dorsey, as head of the archaeology section. The Exposition was the stimulus for a great period of collections building. The most important scientific collections where gathered through the efforts of about 100 scholars in the field under the direction of Dorsey, Putnam, and Boas between 1891 and 1892. Important collections were also purchased from around the world. The Columbian Exposition indeed fulfilled Putnam's vision of a grand exposition of objects from the Americas and beyond, illustrating the archaeology, ethnology, and physical anthropology of the world's cultures.

On November 28, 1891, Putnam urged the Commercial Club of Chicago to take advantage of the opportunity afforded by the Exposition to build a great natural history museum in the city. Through the private donation of Marshall Field and the efforts of Edward E. Ayer, the museum was born and the Trustess of the Exposition assembled the collections and presented them to the new Museum. Franz Boaz was appointed Curator of Anthropology and began his work on the permanent exhibits for the opening of the Museum in June of 1894.

At the time of the 1894 opening, the anthropology collections consisted of approximately 50,000 specimens. The majority of these collections were from the Americas, consistent with the theme of the Columbian Exposition. Unfortunately, Boas, who was to become the intellectual founder of American anthropology as we know it today, resigned from the Museum under pressure from Harlow Higginbotham, the President of the Exposition and Trustee of the new museum. Boas returned to New York as an assistant Curator at the American Museum of Natural History, and eventually was instrumental in founding the Anthropology Department at Columbia University.

Boas was succeeded by William H. Holmes, an archaeologist from the Smithsonian Institution. In this period Holmes conducted a major expedition with Charles F. Millspaugh, Curator of Botany, to Mexico. Holmes resigned late in 1896 to return to the Smithsonian. His successor at Field Museum was George Dorsey, who had been appointed Assistant Curator the year before. Dorsey held the post until 1915. During his incumbency, the anthropology staff was expanded and a very active field program was carried out in North America and Oceania. The Department developed a carefully articulated methodology for the collection of objects. Between 1908 and World War I, Fay-Cooper Cole, William Jones, and Albert Lewis, each Assistant Curators, assembled the Museum's great ethnographic collection from Melanesia and the Philippines with the help of S. C. Simms, Fletcher Gardner, and

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[1] This historical sketch is a rewrite and update of Donald Collier's article "Men and their Work", originally published in the Field Museum Bulletin in September, 1972.

Laura Benedict. Major Native American holdings continued to be assembled, and a fine Egyptian archaeological collection was purchased in Alexandria over a period of only three months. In 1909, Assistant Curator William Jones, the nation's first Native American Ph.D in anthropology, was killed during fieldwork in the Philippines.

Dorsey was succeeded by Berthold Laufer, who had been appointed Associate Curator in 1908. Laufer served as Curator until his death in 1934. With a doctorate in oriental languages from the University of Leipzig, Laufer was a sinologist who was fluent in more than a dozen languages, many of which were non Indo-Eurpoean. He was responsible for assembling many of the linguistic texts in the anthropology library, many of which are unique and irreplaceable sources, as well as most of the Museum's important collection of Chinese and Tibetan artifacts. Major archaeological projects continued in the Americas, including the work of A. L. Kroeber in Peru, J. Alden Mason in Columbia, and J. Eric Thompson in British Honduras (Belize). These three expeditions provided a huge corpus of archaeological collections that remain the core of anthropology's South and Middle American holdings.

It was also during this period that the Anthropology Department firmly established itself as a major research department outside of the New World, with a series of research and collecting expeditions to many areas of the world outside of the Americas including the work of Henry Field in Iraq, Laufer's work in China, and Ralph Linton's work in Madagascar. Laufer and Linton's work in particular stand as major scientific achievements and their work continues to be cited today.

After Laufer's death, Paul S. Martin was appointed Acting Curator and was given the new title of Chief Curator in 1936. Of course, Martin assumed his position in the middle of the Great Depression, and fieldwork was severely curtailed. From 1935 to 1941, there were only four anthropology expeditions, and none were conducted during World War II.

Under Martin's tenure, the Museum purchased from Captain A. W. F. Fuller his great collection of 6,500 ethnographic specimens from Oceania, with the enthusiastic support of Stanley Field. After Captain Fuller's death in 1961, Mrs. Fuller gave the Museum her very important collection of Benin objects from Nigeria. This gift, combined with previous holdings, made The Field Museum's collection of Benin materials comparable to those found in the British Museum and the Museum für Völkerkunde in Berlin.

The end of the war also saw two fundamental changes that affected museum anthropology. First, there was a clear shift from Museum and donor-sponsored expeditions to foundation and government-funded research. Second, foreign nations increasingly forbade the export of valuable archaeological and historical objects. Fortunately, Paul Martin was one of the great archaeologists of the time able to adapt to this changing climate. His research interest was squarely scientific in nature focusing on the interaction of humans within their environment.

Martin was part of a great intellectual movement in archaeology that shifted the focus of research away from historical reconstructions and towards the testing of scientific models of human behavior. As a result, there was a concomitant shift in what archaeologists collected. Instead of focusing on the elaborate objects of the art, archaeologists began collecting scientifically valuable objects, such as potsherds, ancient pollen and bone, soil, and the like. Martin received major funding from the young National Science Foundation and led many research projects to the American Southwest raising the profile of The Field Museum in the anthropological community. He set new standards for archaeological research, and initiated interdisciplinary research designs testing models of human and ecological interactions, defined settlement patterns, documented environmental change, and studied the origins of agriculture and the first settled villages.

Given these shifts in the discipline, it is fortunate that The Field Museum is one of the great museums of the United States that began at the turn of the century when collections could be accumulated from around the world. As a result, The Field Museum has enormous exhibit and research collections that today are not importable from most countries or even some states in the United States. Also, the status of The Field Museum encourages major donations of objects collected and imported when it was legal. Therefore, as Field Museum and other anthropologists continue to collect scientifically valuable objects and strategically add to the collections, these build on enormous existing collections so as to meet the

Museum's research, exhibit, and general educational missions. The scientific framework and the collections strategies of the present Anthropology Department were in essence born in the Martin era. Paul Martin moved to emeritus status in 1964, but continued to be extraordinarily active in the field until his death.

Martin was succeeded as Chair of the Department by Donald Collier, Curator of Middle and South American anthropology. Collier, an archaeologist, had brought major scientific collections to The Field Museum in the 1950's from his excavations in Ecuador and his archaeological reconnaissances in Peru and Ecuador. These included the type collection for an early agricultural site on the coast of Ecuador, and collections of pottery and field notes of many archaeological sites now destroyed in Peru. His work greatly expanded the scope of our Andean collections, and added to those previously collected by Kroeber, Dorsey, and others.

During this period, James W. VanStone joined the Department. One of the eminent Alaskan anthropologists of his time, VanStone conducted extensive archaeological and ethnological research in the Arctic, and continues to extensively publish his materials. Phillip H. Lewis also joined the museum during this period, and began his work on New Ireland culture and art and greatly added to the expertise of the Department in Oceanic anthropology. Glen Cole also joined the Department as Curator of Prehistory and excavated paleolithic sites in Malawi, Tanzania, and Zambia.

James W. VanStone became the first Chairman of Anthropology in the newly devised system of rotating Chairships that continues to the present day. In the 1970's the Department added several new curators: Bennet Bronson, John Terrell, and Michael Moseley. Michael Moseley initiated a major research program in southern Peru, in cooperation with the Southern Peru Copper Corporation. Known as Programa Continsuyu, this large archaeological and museum program provided the umbrella for a number of research projects beginning in 1981 and continuing to the present day.

After James W. VanStone completed his chairship, it rotated to Glen Cole, Phil Lewis, John Terrell, and Bennet Bronson. Throughout this time, the present curatorial staff took its shape, with the addition of Charles Stanish in 1987, Jonathan Haas in 1991, Anna Roosevelt in 1992, Alaka Wali in 1994, and Chapurukha Kusimba in 1994. In 1995, Charles Stanish began his term as Department Chair, replacing Bennet Bronson who had served for two terms.

The Department now officially holds more than 600,000 objects. In reality, this figure is an extremely low estimate, given that one catalog number is generally assigned to a box of specimens that may number into the hundreds. The total collection in anthropology, if assessed as other museums do by individual objects, would number well over 1,500,000 and possibly over 2,000,000 objects. The collection continues to grow, particularly in ethnographic and scientific archaeological objects, and continues to focus its strengths on the American Southwest, the American Midwest, Alaska, Mexico, Central America, the Andes, East Asia, Southeast Asia, the Middle East, Oceania, and sub-Saharan Africa.

Department of Anthropology: Research

The relationship between humans and their environment is the core of the anthropology department's research. Over the past several years, the Museum has consciously sought to develop this research focus as a strategic decision to build an intellectually strong and coherent department. The current department of anthropology is composed of seven curators all of whom concentrate on the relationship between culture, humans, and environment. Six curators are archaeologists who work on the evolution of complex, preindustrial society and one is an ethnologist who works with development projects in Central America and applied anthropology. The anthropology department has maintained a strong connection between curatorial appointments and collections strengths. Presently, curators have research projects in East Africa, Southwest United States, China, Paupa New Guinea, the Andes, urban United States, and Amazonia. Research Associates extend this research scope even further.

Bennet Bronson, Curator of Asian Archaeology and Ethnology, works on evolution of technology and trade in Asia. He notes that "the ancient world had surprising similarities to our own in terms of the importance of commercial competition, the effects of technological progress, and the causes of economic development and decline." In line with these interests he has been involved for a number of years in a program of archaeological and ethnographic work in Asia combined with research on the Asian collections. He has collaborated with several specialists outside the museum on studies of early metallurgy in southeast Asia and China. Along with Chuimei Ho, Adjunct Assistant Curator in anthropology, he has completed most of the analysis of excavations conducted by The Field Museum and the Thai Fine Arts Department at ancient seaports in southern Thailand. Ho and Bronson have also started a three-year project in Southeast China, focusing on the early ceramic and metal industries. This research effort includes work on collections, including studies of Chinese and Japanese bronze objects dating to AD 1400-1900, East and Southeast Asian textiles, and early glass and glaze chemistry. This work promises to throw new light on patterns of early international trade.

Jonathan Haas, Curator of North American Archaeology and Ethnology and his colleague, Winifred Creamer, Adjunct Associate Curator in the Department, have been working on the evolution of cultural systems in the American southwest. They are looking at the effects of European contact and colonialism on the Pueblo peoples of northern New Mexico in the 16th and 17th centuries AD. The initial focus of the project is on changes in the size and distribution of the population of the region during the time just before and after the arrival of the Spaniards in 1540. As part of this research effort, Haas has begun a long term project to inventory, catalog, and analyze the Paul Martin collections here at the Museum (see History section, above). By examining the archaeological and ethnohistorical records of the area we are gaining new insights into the effects of Old World disease and regional warfare on the Pueblo peoples.

Chapurukha Makokha Kusimba, Assistant Curator of African Archaeology and Ethnology, studies the technology, trade, and urbanism on the precolonial Kenyan Coast. Kusimba's work tests models of the development of complex Swahili polities of the East African coast from roughly AD 700-1500. In particular, he has focused on the role of local craft production, especially iron production, in the development of the political and economic relationships between the East African Coast and its Indian Ocean trading partners, the early Indian Ocean trade as a stimulus for technical innovation, economic profit, and as a conduit for the transfer of technologies among East Africa, the Middle East, and South Asia, and the role of coastal and interior peoples in the organization, production, use, and trade of local crafts. In conjunction with this field work, Kusimba began intensive studies of our collections, particularly the Ralph Linton Madagascar collection composed of 3,700 objects that help us understand the rise of complex society in the East African Coast.

Anna Roosevelt, Curator of Archaeology, has focused her research on the human ecology and cultural evolution in Amazonia. Her research focuses on the changing relationship of humans and environments. Since 1983, she has conducted extensive, multi-disciplinary research in the Brazilian Amazon uncovering a long sequence of human occupation. The first humans arrived around 11,000 years ago with cave-painting paleoindians who subsisted on forest fruits, such as Brazil nut, fish, shellfish, and game. Subsequently, people in fishing villages began to make pottery, the earlierst in the Americas circa 8000 BC. Later, people began farming and by AD 1000 had settled in towns and built large earthworks. They traded their fine crafts long distances and fought each other for political control. Roosevelt's work has revised our understanding of Amazonian prehistory, and provides insights not only for archaeology, but for conservation and development planning in the region.

Charles Stanish, Associate Curator of Middle and South American Archaeology and Ethnology, focuses on the evolution of complex society in the Andean highlands, specifically the Lake Titicaca Basin of southern Peru and Bolivia. Stanish currently has two separate projects, one on the Peruvian side of the lake and one on the Island of the Sun, on the Bolivian side of Lake Titicaca. His research team has discovered more than 1,000 archaeological sites in the past six years and has excavated almost one dozen sites. The Titicaca Basin research has defined the evolution of complex agricultural systems, the rise and collapse of ancient empires, the development of imperial ritual centers, and the interaction of humans and environment in the region. Stanish is conducting research on several collections of Inca and earlier materials in the collections as part of this overall reseach program. In particular, he is working on a collection of Inca objects that relates to the Island of Sun research.

John Terrell, Curator of Oceanic Archaeology and Ethnology, studies the origins of complex society and the biogeography of modern peoples in the Pacific Islands. Along with Robert L Welsch, Adjunct Associate Curator of Anthropology, he has recruited an impressive number of research colleagues expanding Field Museum's New Guinea Research Program to include scientists from Northwestern University, Oxford University, Columbia College, and other research departments from around the world. This program studies the biological diversity, the population structure, and prehistory on the Sepik coast of New Guinea, first identified as a major research problem through the analysis of our extensive Oceania collections. The research focused on the nature and processes of regional integration along one of the world's most linguistically diverse areas. In conjunction with this research, Terrell and Welsch collected approximately 1,000 ethnographic objects for the Museum in the past two years, that will be incorporated into our extensive Oceania collections.

Alaka Wali, Associate Curator and Director of the Center for Cultural Understanding and Change, joined the Museum in 1994. Her research focuses on understanding the impact of global economic restructuring on the ways in which people organize themselves and constitute their social identities. As an applied anthropologist, Wali uses the results of her research to formulate more humane solutions to social problems. This research has concentrated on two different sites: Central and South American "hinterlands" and urban areas in the United States. In Central and South America, she has studied the ways in which indigenous people have confronted massive disruption to their use of land and resources as a result of national development projects. In the United States, she has researched the obstacles to resource acquisition for economically disadvantaged groups and the ways in which local social organization forms and cultural strategies can be incorporated into grass-roots empowerment programs.

Department of Anthropology: Collections

African collections

The African ethnographic collections include the Benin collection, one of the most important in the world. The collections from Angola and Madagascar are systematic ones made by field ethnologists in the late 1920s. The Cameroons collection dates to pre-1914 and is one of the world's better collections from that area.

Old world prehistory collections

The old world prehistory collections are comprised principally of stone tools from France and sub-Saharan Africa. Quality ranges from very good (by North American standards) for France, eastern and southern Africa, to fairly good for western Europe in general, to mediocre for the Middle East, and poor for eastern Europe and Asia.

Asian collections

The Asian collections vary greatly in size and quality but several are of outstanding museological and research importance. The Tibetan, Philippine, and western Indonesian collections are among the best of their kind, as are the museum's holding of Chinese textiles, rubbings of inscriptions, and objects relating to the history of Far Eastern technology. The Japanese collection continues to improve significantly through new donations.

Middle Eastern-Egyptian-Mediterranean collections

The Middle Eastern-Egyptian-Mediterranean collections are uneven but of excellent quality. Archaeological holdings from the Middle East are focused on excavated material from the Sumerian Akkadian capital, Kish. The specimens constitute one of the best existing assemblages of objects from a major Mesopotamian urban site, though indifferently recorded as to exact provenance. The purchased and hence poorly documented Egyptian materials cover an exceptionally wide range of periods and cultural activities, with distinguished assemblages of Coptic textiles, stone inscriptions, and Romano-Egyptian objects.

Latin American collections

The Latin American ethnographic collections are from the tropical forest areas of South America, specifically British Guiana and Amazonian Brazil. Major archaeological collections include those from central Mexico, northern Colombia, southern Ecuador, and the central and southern coastal areas of Peru. Much of the South American archaeological material was obtained by A. L. Kroeber on two expeditions in 1925-26.

North American collections

The important North American collections have particular strength in materials of recent Native American groups of the Northwest Coast, Great Plains, and southwestern United States; ancient and recent Eskimos; and ancient cultures of the eastern and southwestern United States. In all these areas the department's holdings rank among the top five in the country. Much of the North American material was obtained in the early 1890s on systematic collecting expeditions for the World Columbian Exposition (1893-94) and on similar expeditions at the turn of the century.

Pacific collections

The Pacific collections are distinguished by one of the world's best assemblages of ethnographic materials from Melanesia, with comprehensive coverage of most lowland areas of the region. The Australian Aboriginal collection represents many Australian areas. Holdings from the Polynesian islands (especially New Zealand) are good to very good. Micronesia is less well represented, but even here the department's holdings have research importance.

Osteological collection

The osteological collection includes remains of individuals, systematically organized by geographical area and sub-divided by tribal groups, subareas, or nationality. This material comes from all parts of the world, with particular strength in the New World, Melanesia, and Mesopotamia.

DEPARTMENT OF ANTHROPOLOGY - COLLECTION SIZE AND GROWTH

	1994 Number of Specimens	1995 Number of Specimens	1994-1995 % growth
Africa			
Sub-Saharan, History-Ethnograph			
Cameroon, Nigeria and West Africa	5,319	5,406	1.63
Benin bronzes	104	104	0
Angola and Zaire	850	850	0
East and South	3,843	3,877	0.88
Madagascar, History-Ethnography	3,770	3,770	0
Egypt, Archaeology	2,820	2,820	0
Coptic textiles	670	670	0
General, Prehistoric Archaeology	141,940	141,940	0
General and Other, History-Ethnography	1,603	1,603	0
Subtotal Africa	**160,919**	**161,040**	**0.08**
Europe			
Italy, Archaeology			
Etruscan	280	280	0
Roman and Graeco-Roman	1,080	1,080	0
Pompeii	200	200	0
Other, Archaeology and History-Ethnography	120	120	0
General, Prehistoric Archaeology	45,700	45,700	0
Subtotal Europe	**47,380**	**47,380**	**0**
Asia			
East Asia, Archaeology and History-Ethnography			
China,	15,644	15,661	0.21
Rubbings	5,000	5,000	0
Textiles	3,000	3,000	0
Tibet	4,401	4,401	0
Japan	3,931	3,935	0.10
Sword furniture	1,060	1,060	0
Other (Korea, Siberia, etc.)	702	702	0
Southeast, History-Ethnography			
Philippines	9,151	9,151	0
Indonesia-Malaysia	6,461	6,462	0.02
Mainland			
Burma	246	246	0
Thailand	130	139	6.92
South, Archaeology and History-Ethnography			
India, Nepal, Bangladesh	2,420	2,420	0
Sri Lanka	430	430	0
Pakistan and Afghanistan	823	823	0
Middle East			
Iran and Jordan, Archaeology	300	300	0
Iraq, Archaeology	31,500	31,500	0
General Ethnography	100	105	5.0
Other (Central, West)	100	100	0
Subtotal Asia	**85,399**	**85,435**	**0.04**

DEPARTMENT OF ANTHROPOLOGY - COLLECTION SIZE AND GROWTH (cont.)

	1994 Number of Specimens	1995 Number of Specimens	1994-1995 % growth
South America			
Andean Area, Archaeology	16,900	16,900	0
Andean Area, History-Ethnography	704	707	0.43
Amazonia and Marginal, History Ethnography	5,421	5,421	0
General, History—Ethnography	50	50	0
Subtotal South America	**23,075**	**23,078**	**0.01**
Central And Middle America			
Mainland, Archaeology	10,600	10,600	0
Mainland, History-Ethnography	2,720	2,768	1.76
Caribbean, History-Ethnography	954	956	0.21
Subtotal Central and Middle America	**14,274**	**14,324**	**0.35**
North America			
Artic, History-Ethnography	4,921	4,922	0.20
Northwest Coast, History-Ethnography	6,953	6,954	0.01
California, History-Ethnography	4,355	4,355	0
Plains and Basin, History-Ethnography	15,174	15,175	0.01
Southwest, History-Ethnography	5,610	5,613	0.05
East and Central, History-Ethnography	3,207	3,207	0
General, History-Ethnography	150	150	0
Southwest and Central, Archaeology	185,000	185,000	0
Subtotal North America	**225,370**	**225,376**	**0.002**
Pacific			
Australia, History-Ethnography	1,561	1,561	0
New Guinea, History-Ethnography	16,271	16,271	0
Melanesia, History-Ethnography	14,901	14,902	0.01
Polynesia, History-Ethnography	5,256	5,257	0.02
Micronesia, Archaeology, History-Ethnography	11,270	11,270	0
General, History-Ethnography	100	100	0
Subtotal Pacific	**49,359**	**49,361**	**0.004**
Osteological Collection			
	4,689	**4,696**	**0.15**
Anthropology Total	**610,465**	**610,690**	**0.04**

DEPARTMENT OF BOTANY

Department of Botany: History

Field Museum acquired its first botanical collections from the World's Columbian Exposition of 1893 when Charles F. Millspaugh, a physician by training but an avid botanist and naturalist, began soliciting donations of exhibited collections for the museum. These were largely materials of economic use: collections of gums, resins, fibers, oils, waxes, tannins, dyes, starches, cereals, sugars, spices, medicinal plants, timbers, and cabinet woods offered by more than twenty countries. In this manner the Department of Botany began with a fine collection of cabinet woods, forest products, and useful plant products. These original specimens today comprise the Economic Botany collection at The Field Museum.

Millspaugh, who in 1887 published a major work on American medicinal plants, became the first appointee to the scientific staff as the Curator of Botany. The herbarium was established in 1894, and numbered 50,000 specimens by 1898. Millspaugh made important collections in the Yucatan Peninsula in the period 1894 -1896, and in the West Indies during 1899-1907. From this time on, the Museum concentrated its efforts on the American tropics, sponsoring or co-sponsoring more than sixty botanical expeditions to the region, and establishing one of the world's major collections of Central and South American plants. Some major contributors to the development of the collections are noted below.

Jesse H. Greenman collected extensively in Mexico and Central America from 1904-1912. J. Francis Macbride, who joined the staff in 1922, worked in Peru and initiated one of the department's major floristic works, the Flora of Peru, (8,508 pages of which have been published to date). Paul C. Standley joined the staff in 1927 and began extensive fieldwork in Central America. Since Standley frequently did not make duplicates, many of his collections at Field Museum are unique, at least within United States herbaria. Among his many publications are The Flora of the Lancetilla Valley (Honduras), The Flora of Costa Rica, The Rubiaceae of Colombia, also of Ecuador, of Bolivia, and of Venezuela. In 1938 he began The Flora of Guatemala, which also attracted many new collections to the Museum. Standley's many achievements, together with a phenomenal memory that allowed him to identify on sight an estimated 20,000 species from Mexico and Central America earned him an enduring place in the history of American botany. Standley was later joined in the Flora of Guatemala project by Julian Steyermark, who joined the staff in 1937 and made numerous valuable collections in Guatemala and contributed to the published flora. Steyermark also completed the Flora of Missouri while at Field Museum, and deposited his study specimens here. In the 1940's, Steyermark initiated collecting programs in Venezuela and Ecuador, and The Field Museum's holdings of these early collections are not duplicated elsewhere in North America. Louis O. Williams joined the staff in 1960, and supervised the completion of the Flora of Guatemala (thirteen parts, 6,528 pages). Williams also collected widely in Central America, and developed an active research program that supported the work of other collectors, such as Antonio Molina of Honduras. Williams served as departmental chair from 1964-1973, and in 1965 appointed William Burger to begin working on the Flora of Costa Rica project.

While neotropical floristics of flowering plants has been a major focus in the history of the department, several staff have distinguished themselves in other areas: Llewelyn Williams in economic botany; Francis Drouet in algae; B. E. Dahlgren in palms; and Theodor Just in evolutionary biology and paleobotany.

Department of Botany: Research

Current staff in the Department continue the strong tradition of botanical research in the Neotropics with a variety of projects in Peru (Michael Dillon), Costa Rica (William Burger) and Central and South America (Thomas Lammers). Among cryptogams, a major emphasis is on liverworts, particularly leafy liverworts from the Southern Hemisphere (John Engel) of which the Museum has major collections. In mycology (Gregory Mueller), Museum programs include studies in North America, South America and China. In addition to Department of Botany curators, resident Research Associates Robin Foster and Doel Soejarto have active programs in the department.

Department of Botany: Collections

The Department of Botany manages the fifth largest herbarium in the Western Hemisphere, estimated to include 2.54 million specimens of angiosperms, gymnosperms, pteridophytes, bryophytes, fungi including lichenized ascomycetes, and algae. The department includes the research collections, libraries, a general purpose laboratory, plant preparation area, mounting, sorting and shipping areas, and office and research areas for curators, resident research associates, and visiting scientists. The Botany staff has managed and maintained its vast collections and has made them accessible to researchers worldwide, at levels of activity comparable to those of larger institutions focused exclusively on botanical research and education.

The Herbarium was established in 1894 based on acquisitions from the World's Columbian Exposition of 1893. Numerous botanical expeditions, sponsored or co-sponsored by The Field Museum have established the herbarium as one of the world's preeminent depositories of Central and South American plants and approximately sixty percent of the phanerogam collections are from these areas. Important early collectors included C. Millspaugh, J. H. Greenman (Mexico and Central America) and B. E. Dahlgren (Cuba, Brazil, and British Guiana). The Flora of Peru, initiated in 1922 by J. F. Macbride is continued today by M. O. Dillon. Specimens generated from this project have provided The Field Museum with one of the world's best collections of Peruvian plants. Macbride also spent nearly ten years in Europe photographing type specimens of South American plants at major European botanical institutions and arranging for exchange of numerous Latin American specimens (many of them unmarked types from the herbaria in Vienna, Paris, Madrid, Geneva, Munich, and Berlin) of collectors that are not well represented in other United States herbaria (e.g., Ruiz and Pavon, Blanchet, Glaziou, Pohl and Schott).

Mycology: Collections

The Mycology Collection at The Field Museum is a major resource for mycological systematic and biodiversity studies. It consists of approximately 157,000 specimens with world-wide coverage and broad taxonomic representation. It is rich in type collections, especially of Neotropical taxa. The greatest strengths of the collection are the Agaricales *sensulato* (e.g., mushrooms, boletes, false-truffles, puffballs, chantrelles, tooth fungi, and coral fungi) and the lichenized Ascomycetes of the Western Hemisphere. The collection is especially significant in that it is one of only two active, large centers for Neotropical Agaricales in North America, and one of only a handful of herbaria active in such studies in the Western Hemisphere. Specific components of the collection are discussed below.

Agaricales--The collection attained worldwide prominence largely through the efforts of the late Rolf Singer, resident Research Associate for twenty-five years and author of *The Agaricales in Modern Taxonomy,* now in its fourth edition (Singer, 1986) (see Mueller, 1994; 1995). Singer was the most active student of Tropical American Agaricales (e.g., Singer and Morello, 1960; Singer 1976, 1987, 1988, 1989, Singer et al., 1983, 1992; Singer and Gómez, 1984; Singer and Araujo, 1986). He also collected and published widely on extralimital American taxa (e.g., Singer, 1989; Singer and Hausknecht 1990). Many of his collections, including types, and all of his field books and collection notes which include unpublished descriptions, illustrations and keys, are deposited at The Field Museum. A computerized index to the more than 2,500 new taxa (not counting new names and new combinations) published by Singer during his 70-year career has been completed (Mueller et al., 1992; Mueller et al., in preparation). It documents 595 holotypes at The Field Museum with the remaining types distributed in forty-one other herbaria. In addition to having the largest number of Singer types, The Field Museum houses authentic material of many of his other taxa. Singer's collections and notes are indispensable for systematic, ecological and biodiversity studies of higher fungi and are a major strength of the Museum's holdings.

Other important holdings of Agaricales include the 10,000 specimens of E. T. Harper, which represents one of the preeminent collections of fungi from the central Great Lakes region. These specimens were used as the basis of several books on the fungi of the region (e.g., Moffat, 1909; Graham, 1933, 1970). These midwestern collections have been supplemented by numerous more recent collections by Mueller, Singer, Wu, Huhndorf, members of the Illinois Mycological Association, and by the recent acquisition of the fungal herbarium from the Ford Forestry Center, L'Anse, Michigan (1,500 specimens from the Upper

Peninsula of Michigan). The Field Museum also houses one of the largest and most complete collections of Agaricales from the Gulf Coast States. This collection includes over 3,500 specimens of east Texas fungi donated by D. P. Lewis (Vidor, Texas). Recently, W. Cibula (Picayune, MS) has committed to donate his large collection of Louisiana and Mississippi fungi to Field Museum. These Gulf Coast collections complement the major collecting program on neotropical oak and pine forest fungi being undertaken by Mueller and colleagues. Besides Singer's and Mueller's specimens, outstanding collections from Mexico and Central America include those of J. García (eastern Mexico)and L. D. Gómez and associates (Costa Rica). The collections of Singer, Mueller, and Gómez constitute the largest and most important holdings of Central American Agaricales in the world.

Ascomycetes--This important component of our herbarium has nearly 90,000 specimens. The lichenized ascomycete collection has broad taxonomic and geographic representation with its major strengths in North and Central American material. Among its important holdings are North American collections compiled by A. W. Herre, E. Hall, and A. B. Seymour; Central American material collected by P. C. Standley (Guatemala, Honduras, Nicaragua) and J. A. Steyermark (Guatemala); and European collections of C. Sbarbaro. There is also a large Illinois and Chicago area component to the collection. The nonlichenized ascomycete collection also has broad taxonomic and geographic representation. The Great Lakes region is well represented by the collections of E. T. Harper, while P. C. Standley and J. Steyermark deposited Central and South American material. The collection includes a large number of European specimens that were distributed by P. Sydow, O. Jaap, P. Vogel, and the Fuckel Herbarium. Recently, the collection has seen a sharp increase in the number of tropical loculoascomycetes and pyrenomycetous ascomycetes due to the activities of Resident Research Associate Sabine Huhndorf.

While the Mycology Collection at Field Museum has long been recognized as an important source of information by the systematics community, it has seen a marked increase in activity since Mueller joined the curatorial staff (1985) and focused on improving curation procedures and increasing the use of the collection by the mycological community. Several recent workers have used The Field Museum as the repository of their collections (e.g., J. García, K, M Leelavathy, D. P. Lewis, J. D. Lodge, and C. Ovrebo). This has resulted in the acquisition of well over 6,000 collections including type specimens from a number of Central and South American countries. In addition to these gifts, growth of the collection has occurred through the active field program of Mueller and colleagues (e.g., Singer, 1989; Singer et al., 1992; Mueller and Singer, 1988; Mueller and Rajchenberg, 1991; Mueller, 1991, 1992; Mueller and Strack, 1992; Petersen and Mueller, 1992). Current field work is focused on a survey and inventory program of the Agaricales of Costa Rican oak forests. Together these activities have resulted in a twenty percent increase in holdings since 1986 and have stretched the current collection space beyond its limits.

Lichens: Collections

The lichen collection consists of 52,000 specimens, including 1,405 types, and ranks sixth nationally. Important collections include those of A. W. Herre and E. Hall (North America), P.C. Standley (Guatemala, Honduras, Nicaragua), J. A. Steyermark (Guatemala), C. Sbarbaro (Europe) and A. B. Seymour (Eastern North America).

Algae: Collections

This collection consists of 78,000 specimens, including 1,131 types and ranks among the top five in the United States. The collection is strong in marine taxa from North America, including material from both the Atlantic and Pacific coasts. Important collections include those of M. Doty, D. C. Eaton, H. Habeeb, F. Wolle, and M. Nitecki. The collection includes representative exsiccatae from Europe and North America. This herbarium also contains the cyanobacteria collection of F. D. Drouet, and consists of one of the world's largest collections of that group (30,000 specimens).

Bryophytes: Collections

North American bryophytes comprise about one-third of the collection (60-70,000 specimens), and include material from a large number of collectors. Many of these were acquired by the Museum through gift of Elmer J. Richards, including the large moss collection of A. B. Seymour, mostly from the northeast United States. Regionally, the herbaria of Elihu Hall and H. N. Patterson are especially noteworthy, containing early Illinois collections of bryophytes dating from the early- to mid-1800's.

Here also, there are differences in representation between the two major bryophyte groups. About one-third (ca. 20,000 specimens) of the North American mosses are Midwestern, and of these ca. 10,000 specimens are from the Chicago Region, comprising the states of Illinois, Indiana, Michigan and Wisconsin. Regional representation of hepatics is much lower (ca. 1,000 specimens), reflecting the much smaller number of hepatic species in the region as compared to mosses.

The bryophyte collection at The Field Museum is a major resource for bryophyte systematics, particularly for Central and South American, temperate Australasian, North American, and European taxa. The collection consists of more than 180,000 specimens, including 127,614 moss and 51,508 hepatic specimens with a total of 2,284 types. Representation from south temperate regions is particularly strong and includes the collections of J. Engel (hepatics), R. M. Schuster (hepatics), H. Roivainen (hepatics and mosses, southern South America), R. E. Hatcher (hepatics, Chile and New Zealand), J. Child (ca. 3,000 mosses and 2,000 hepatics, New Zealand), G. O. K. Sainsbury (mosses, New Zealand), and R. Ochyra (hepatics and mosses, Antarctica). The collection also includes a complete set of the Guatemalan mosses collected by Standley and Steyermark which served as the basis for Bartram's Mosses of Guatemala (Bartram, 1949), as well as the hepatics, which have never been determined or published. Other important holdings include the personal herbarium of R. S. Williams, which includes significant early collections from Bolivia, the Yukan and Montana, including many types.

Major areas of geographic strength in the collection include North America, Europe, Central and South America, and Australasia. The hepatic collection is notable for its strong representation in south temperate regions; the moss collection for its North American, Central American, and Andean South American coverage. Notable differences between the moss and hepatic holdings sampled are seen in the representation of specimens from south temperate regions (temperate South America and Australasia), and from tropical America. South temperate material accounts for nearly half (ca. 23,000 specimens) of the hepatics, as compared with an estimated 6,500 mosses. By contrast, tropical American specimens represent about one-fourth (ca. 33,000 specimens) of the mosses, versus only approximately 3,000 hepatics. The preponderance of south temperate hepatics reflects not only the focus of research activity over the past twenty years, but also the fact that the center of origin and diversity of hepatics is in the temperate regions of the Southern Hemisphere. Mosses, on the other hand, are numerous and well-represented in both temperate and tropical regions of the world.

Significant growth of the collection has occurred through the active research programs of Field Museum staff. John Engel's continuing floristic and monographic research on austral Hepaticae has made Field Museum one of the centers for studies of this group (Engel, 1980; Schuster and Engel, 1985). Resident Research Associate Gary Merrill's research on Polytrichaceae continues to elicit requests for identifications of specimens of this family, which become part of the permanent collection (Merrill, 1992, 1993). In addition, a large set of North American bryophytes (ca. 1,000 specimens), collected by Merrill over the past five years, chiefly from the Great Plains region, is being incorporated into the permanent collection.

The Schuster Collection--The most significant component of the bryophyte collection at The Field Museum is the recently purchased hepatic herbarium of R. M. Schuster, which is equal in world-wide geographical coverage, systematic breadth, and nomenclatural importance to the major 19th century hepatic collections of Stephani (G) and Schiffner (FH). The herbarium (ca. 58,000 specimens) is being transferred to The Field Museum in stages. 17,000 specimens have been received to date including material relevant to Volumes 1-4 of Schuster's Hepaticae and Anthocerotae of North America (Schuster, 1966, 1969, 1974, 1980), and miscellaneous Australasian research material. The remainder of the Schuster herbarium (ca. 41,000 specimens) will be transferred to The Field Museum within the next decade. When the transfer is complete the Schuster collection will almost double the number of hepatics at Field Museum and establish the museum collections as a unique international resource for research on the systematics of Hepaticae and Anthocerotae.

The Lewis Collection--A major field program by Field Museum associate Marko Lewis in Alaska, Hawaii, Ecuador, and Bolivia, beginning in 1973, has led to acquisition of an estimated 22,000 specimens of bryophytes. Especially important is a large collection of Bolivian bryophytes, which was essentially inaccessible in its original condition. Specimens were collected for the most part in remote areas rarely visited by collectors, and are provided with extensive habitat data. In view of the rapid disappearance of tropical ecosystems, this collection represents a significant and irreplaceable resource. When the Lewis Bolivian collections (ca. 16,000 specimens) are studied by specialists they will inevitably yield many new taxa, as well as material documenting variation, distribution, and ecology of rare and poorly understood species.

The Mary Taylor Herbarium--The importance of the southern Appalachians as a reservoir of rare and relictual taxa has long been recognized. In 1985, Field Museum acquired the Mary Taylor collection of ca. 8,000 specimens of Hepaticae, which consists primarily of collections from the southern Appalachians, but also from various remote areas of Florida. Included are irreplaceable collections made in the late 1920's and 1930's in these now threatened and declining ecosystems, and many are from habitats that have long since been destroyed. The herbarium is in excellent condition despite its age, and includes a presently unknown number of types, as well as extensive field notes and correspondence. Mrs. Taylor took special care to secure sporophyte material whenever available, and the collection is particularly rich in these especially valuable specimens. The collection was received in a condition requiring considerable curation, but all specimens have now been organized and locality data for the entire collection have been entered into the cryptogamic database.

The Richards Central American and North American Mosses--Along with his personal bryophyte herbarium, the late Donald Richards bequeathed to Field Museum an estimated 1,200 specimens of unidentified mosses from Mexico, Guatemala, Honduras, and Nicaragua gathered by Richards, Louis O. Williams and others (Engel, 1981). Also included are an estimated 1,500 unidentified United States specimens, chiefly mosses.

Pteridophytes: Collections

The pteridophyte collection ranks fourth in the nation in size and includes more than 106,000 specimens of ferns and fern allies, including 373 types. The collection is worldwide in scope but has a strong concentration in tropical America. The Ferns and Fern Allies of Guatemala (Stolze, 1976, 1981, 1983) and Pteridophyta of Peru (Tryon and Stolze, 1989a,b, 1991, 1992, 1993, in press) were based primarily on our holdings. Central American and Mexican collections include the outstanding material of Standley, Steyermark, Molina, and L. O. Williams (Guatemala), Matuda, Ringle and Purpus (Mexico), Molina, Williams, Shimek (Nicaragua), and Brenes and Austin Smith (Costa Rica). South American material includes specimens from J. F. Macbride, Mexia, Killip and Smith, and both Carlos and José Schunke (Peru), Cuatrecasas (Colombia), Steyermark and Llewelyn Williams (Venezuela), Acosta Solis (Ecuador), Buchtien and Steinbach (Bolivia), and Brade (Brazil). Although Old World specimens are not especially numerous, they include valuable collections of Blanchard (Africa), Boivin and Humblot (Réunion, Madagascar) and Zenker (Cameroon).

Gymnosperms: Collections

The gymnosperm collection consists of approximately 12,000 collections, including thirty-seven types. There is good representation of Gnetaceae, Ephedraceae, Cycadaceae, and Pinaceae with the bulk of the Pinaceae from the United States and Mexico. In addition to herbarium sheets, the collection contains a large number of cones which are housed separately.

Flowering Plants: Collections

Of the 2.4 million specimens housed in the Department of Botany, more than 2 million are flowering plants which ranks as the fifth largest collection of flowering plants in the nation. This number includes 32,500 type specimens, estimated in 1995. Strong representation of neotropical taxa is credited to the many floristic projects and collection-oriented research programs that have been an integral part of the department since its inception. Especially rich are holdings in the neotropical families Rubiaceae, Asteraceae, Palmae, Piperaceae, and Solanaceae, primarily due to the work of present or former staff botanists. The Central American material is overall one of the world's finest single collections with special strengths in Guatemala, Honduras, and Costa Rica. The South American collections are important with special strengths in Venezuela, Colombia, Ecuador, and Peru. A good representation in North American taxa is found, especially for Missouri and Illinois, and unmarked types are commonly discovered in these holdings. Some major contributors to the development of the collections are noted below.

Jesse H. Greenman collected extensively in Mexico and Central America from 1904-1912. B. E. Dahlgren concentrated on collecting palms in Cuba, Brazil and British Guiana, his most active field work being conducted between 1909 and 1938. J. Francis Macbride initiated the Flora of Peru in 1922, and added significantly to the Peruvian holdings through his own expeditions and through attracting collections of others.

In recent years the botany department has collaborated on the Flora of Veracruz, Mexico project from 1973-1985 resulting in the herbarium housing the nation's best collection of plants from that area. During the 1980's South American representations increased due to the collecting efforts of Timothy Plowman whose expeditions included trips to Brazil, Colombia, Ecuador, Peru and Venezuela.

More recently, floristic projects and collection-oriented research programs have continued to build on our Neotropical strengths, particularly in Central America with Williams Burger's Flora Costaricensis and Michael Dillon's coordination of the Asteraceae for the Flora of Nicaragua project. The collections of Michael Dillon have greatly improved our holdings from Peru and Chile as he continues floristic and monographic efforts in the Peruvian flora. His work on the Asteraceae over the past ten years has added numerous specimens to that family's holdings. Thomas Lammers is providing monographic efforts for the Campanulaceae in Peru and Chile. Resident research associates maintain active programs that contribute to collection strength, including Robin Foster's inventory projects in Peru, Panama and Bolivia, and Doel Soejarto's drug plant exploration, especially in the Paleotropics.

The herbarium also expanded through purchase of major private collections and through acquisition of the herbaria of the University of Chicago, Northwestern University, and the Department of Pharmacy, University of Illinois at Chicago, among others. The Field Museum is likely to continue to play an important role in the future, serving as a repository for such "orphan" collections.

The Field Museum curates an extensive collection of dried fruits, large seeds, bark and other plant parts that generally are not accommodated on herbarium specimens. A seed collection consisting of some 6,400 glass vials also is maintained by the Department. A reference collection of 3,600 pollen slides is maintained and increased through exchange. In addition, 1,030 anatomical slides are preserved.

Timothy C. Plowman Economic Botany Collection

The Economic Botany collection had its origin in the World Columbian Exposition of 1893, and was especially enriched by gifts from the national exhibits of British Guiana, the Philippines, Japan, Brazil, Burma and India. Specimens also were acquired from the Paris Exposition (1901), the Louisiana Purchase Exposition (1904), and the Panama-Pacific Exposition (1915), as well as numerous Field Museum sponsored expeditions. The collection was recently enhanced by the acquisition of more than 2,000 pharmaceutical specimens from the College of Pharmacy, University of Illinois, Chicago. The Economic Botany collection, of more than 12,000 specimens, uniquely represents plant products and artifacts that complement the Museum's more traditional herbarium collections. Comprehensive collections of economic plant materials are rare and the collection at Field Museum is rivaled by few institutions in the world.

Type Photograph Collection

The Botany Department's unique type photograph collection originated in 1929 when J. Francis Macbride, funded by the Rockefeller Foundation, traveled to Europe to photograph herbarium specimens of nomenclatural types. The intent was to make the photographs available to American botanists unable to finance travels to European herbaria; the widespread adoption of the loan process was not as fully developed as it is today, necessitating travel for consultation. Over a ten year period, Macbride photographed type specimens of tropical American plants at the following major herbaria: B, C, G, HAN, HBG, MA, M, P, and W, using Berlin-Dahlem and Geneva as bases of operation. His sojourn in Europe resulted in more than 40,000 photographic negatives, and duplicate collections, types, and type fragments of authentic material which were selected and sent to The Field Museum as exchange. The results were of immediate importance to American systematic botany, but acquired added meaning following the destruction of parts of some European herbaria during World War II. In some instances, the only visual record of a species is one of these photographic prints. The Type

Photograph Collection now consists of more than 65,000 negatives. Continuous additions to this collection are made primarily by systematically photographing types in The Field Museum's vascular plant herbarium as well as types and authentic specimens received on loan from other institutions. The collection data for all of these are in database form.

DEPARTMENT OF BOTANY - COLLECTION SIZE AND GROWTH

	1994 Number of Specimens	1995 Number of Specimens	1994-1995 % growth
Algae	78,132	78,132	0
Fungi: Basidiomycetes	60,480	61,944	2.42
Fungi: Ascomycetes and Miscellania	33,439	33,467	0.08
Lichens	52,461	52,461	0
Bryophytes	184,157	184,157	0
Pteridophytes	114,305	114,805	0.44
Gymnosperms	10,425	10,500	0.72
Angiosperms	2,027,678	2,035,749	0.40
Botany Total	**2,561,077**	**2,571,215**	**0.40**

DEPARTMENT OF GEOLOGY

Department of Geology: History

The first chair of the department, Oliver C. Farrington, came to the museum at the time of its founding in 1893. Farrington built the collections into worldwide importance during his tenure. Elmer S. Riggs, appointed shortly after The Field Museum's opening, became the first paleontology curator, and assembled the nucleus of the vertebrate paleontology collections. Riggs collected many dinosaurs from the Rocky Mountain states and Canada, and led several expeditions to South America where he amassed an outstanding Cenozoic mammal collection.

Henry W. Nichols, the second chair, specialized in mineralogy. He was followed by Sharat K. Roy, who studied in his native India, London, and Illinois, and led a number of museum expeditions, including those to Baffin Land and Labrador in 1927-1928. Bryan Patterson, on staff from 1926 to 1955, published extensively on Riggs' collection of South American fossil mammals, and made several major collections in the United States, including those from the Piceance Basin, one of the first significant Paleocene fossil vertebrate faunas. His collection and studies on the Trinity Cretaceous mammals of "metatherian-eutherian grade" from north Texas was a major contribution to mammalian paleontology.

Rainer Zangerl became head of the department in 1962 after serving seventeen years as curator of fossil reptiles. Zangerl extended his interest to Pennsylvanian paleoecology, and co-authored (with Eugene Richardson) a now classic memoir on paleoecology of Pennsylvanian black shales. Zangerl was succeeded in 1974 by Edward J. Olsen, who came to the museum in 1960 after teaching at Case Institute of Technology and Western Reserve. David M. Raup joined the geology staff as department chair in 1978, following faculty positions at the California Institute of Technology, Johns Hopkins, the University of Rochester, and the University of Chicago. John R. Bolt became department chair in 1981, following a period in which Bertram G. Woodland was acting chair. Bolt received his doctorate from the University of Chicago, and joined the museum in 1972 after several years of teaching at the University of Illinois at Chicago. Peter R. Crane joined the Department in 1982 and served as Chair from 1990-1992 before taking a more senior administrative position. The current chair, John J. Flynn, joined Field Museum's geology staff in January, 1988, following several years as a professor in the Department of Geological Sciences at Rutgers University.

Department of Geology: Research

The Department of Geology maintains a primary focus on paleontological research, with curators covering fossil mammals, fossil fish, fossil plants, fossil reptiles and amphibians, and fossil invertebrates. The study of meteoritics has been and continues to be the department's other major research area. The scientists in the Department of Geology, together with colleagues at area universities, form an integral part of one of the nation's largest concentrations of paleontologists, and one of the key meteoritics research groups in the world.

Fossil Mammals: Research
J. Flynn's research emphasizes mammalian paleontology and systematics, and paleomagnetism and geochronology. Current research uses DNA sequencing and anatomy of fossil and living taxa to analyze the higher-level evolutionary relationships of the Carnivora and rates of molecular, taxic, and morphological evolution. Recent field work has yielded new fossil mammal faunas, providing new insights into the biogeography, temporal history, and evolution of the highly endemic South American mammal fauna, and the age and patterns of change between early Cenozoic and North American mammal faunas. W. Turnbull's current studies of mammalian systematics and evolution focus on late Tertiary and Pleistocene mammalian faunas of Australia, and the 50 million-year-old mammalian fauna of the Washakie Formation in Southwestern Wyoming, with current emphasis on uintatheres and marsupials. Other projects examine the functional anatomy of the masticatory musculature of the Eocene taeniodont *Stylinodon*, the multituberculates of the Early Cretaceous (Trinity Group) of North Texas, and problems in paleopathology and taphonomy. S. McCarroll's research concentrates on the faunas and the biostratigraphy of the Washakie Formation, with current studies involving description

of the perissodactyls and artiodactyls, and reviews of the faunas of the very upper and lower-most rock units of the formation. G. Buckley's studies include the systematic treatment of 64-million-year-old mammals from the Crazy Mountains Basin of Montana and a reanalysis of the temporal zones used for North American mammals of the period.

Fossil Fishes: Research

L. Grande studies the comparative osteology and ontogeny in fossil and living fishes, with a particular emphasis on the ray-finned fishes (Actinopterygii). Some of the groups he has studied include the Siluriformes (catfishes), Clupemorpha (herring and herring-like fishes), Osteoglossomorpha (bony-tongues) and other more primitive actinopterygian groups such as sturgeons, paddlefishes, amiiforms, gars and polypterids. Recent research also addresses different types of intraspecific morphological variation (e.g., ontogenetic vs. non-ontogenetic) and its effects on phylogenetic reconstruction, problems regarding inclusion of fossils in phylogenetic studies, and historical biogeography.

Fossil Reptiles: Research

J. Bolt focuses on the early diversification of tetrapods, particularly amphibians, from the Mississippian, Pennsylvanian, and Early Permian age (ca. 360 to 270 myr B.P.). The relationships and morphology of primitive amphibians from a new Mississippian locality in Southeastern Iowa constitutes one area of current research. Other studies examine the fossil evidence for the origin and evolution of the tetrapod auditory system and its implications for otic evolution and tetrapod relationships, and the origin and early evolution of the living amphibians (lissamphibians). O. Rieppel's primary research focus is the analysis of phylogenetic relationships of marine Mesozoic reptiles, specifically the Triassic stem-group, the Sauropterygia, from the northwestern United States, Europe, Israel, and China. Related research addresses problems of skeleton formation in all three major clades of extant reptiles (lizards, crocodiles, and turtles), focusing on patterns and sequences of ossification. He also conducts studies in the philosophy and methodology of systematics and its relation to evolutionary theory. G. Buckley's research focuses on the systematic relationships and biogeography of the Late Cretaceous crocodilian fauna of Madagascar. Fieldwork conducted in 1993 and 1995 has produced a number of specimens that will help shed light on the nature and origin of the Malagasy fauna during the Age of Dinosaurs.

Fossil Invertebrates: Research

S. Lidgard continues his work on the evolution and ecology of cheilostome bryozoans, with a particular emphasis on species recognition and the relationships of colonial growth and form, for example, how different modes of growth relate to large-scale patterns of evolution, environmental distribution, and ecology. Related research attempts to re-evaluate the role of competition in large-scale evolutionary replacements (e.g., dinosaurs vs. mammals, brachiopods vs. clams). M. Nitecki's work emphasizes the study of cyclocrinitids and receptaculitids, problematic fossils that do not fit into any living phylum, and thus represent early evolutionary experiments that prompt reconsideration of the history of life. He also writes on the history and sociology of science (e.g., the underlying structure of scientific attitudes and beliefs), and theories of evolutionary biology. P. Wagner's research focuses on the origins and maintenance of morphological and taxic diversity, contrasting the evolutionary dynamics of "failures" (e.g., rostroconchs, paragastropods, bellerophontid gastropods) with those of very successful mollusks (e.g., gastropods). Other research examines the distribution of soft anatomy characters and morphogenetic trajectories across gastropod phylogeny. This research integrates paleontological and neontological data to examine the effects of developmental constraints on two basic aspects of biodiversity: numbers of morphologic types and numbers of species encompassed by those types.

Fossil Plants: Research

P. R. Crane devotes primary study to the evolution of angiosperms and associated patterns of Cretaceous vegetational change. Other current projects involved the initial diversification of land plants, origin of seed plant biology, and evolution of water-conducting tissues. Field work in North America and central Portugal recovered well-preserved microscopic flowers of early angiosperms and related plants from the mid-Cretaceous (about 100 myr B.P.). Investigations of this material will improve understanding of large-scale biotic and environmental changes that occurred during this period. P. Herendeen's work on the evolutionary history of plants is directed at the paleobotany and systematics of the legume family, and the Cretaceous fossil record of flowering plants (angiosperms). Current legume research involves a paleobotanical and neobotanical study of the subfamily Caesalpinioideae; other projects include a study of Cretaceous fossil floras of the southeastern Atlantic Coastal Plain, and an examination of the structural evolution in the wood of early angiosperms.

Meteoritics: Research

M. Wadhwa studies primitive meteorite groups (including enstatite chondrites, eucrites, and mesosiderites) as well as some of the youngest known meteorites (e.g., the SNC or "martian" meteorites). Her current research on these widely diverse objects seeks to decipher the processes involved in their formation using trace element distributions in their minerals, and to determine the time scales of their formation using long-lived (Samarium-Neodymium and Rubidium-Strontium) and short-lived (Manganese-Chromium) chronometers, in order to better understand meteorite formation events and their chronology in the solar system.

Department of Geology: Collections

Paleontology Collections

The Field Museum paleontological collections include those of the former Walker Museum of the University of Chicago and are very highly ranked, both nationally and internationally. The paleontological collections now number almost 600,000 specimens (several millions if individual items within specimen lots are counted separately) and include historically important material collected by J. Hall, S. and J. M. Weller, S. A. Miller, A. Noe, E. S. Riggs, B. Patterson, and R. Braidwood among others. In numbers of specimens, the Geology Department at The Field Museum ranks third or fourth among all paleontological collections in the United States and among the top ten of such collections worldwide. The Vertebrate Paleontology collections at Field Museum rank fourth in size nationally with more than 125,000 specimens. The invertebrate paleontology collections rank third nationally with over 319,000 specimens, and are also rated third among the most significant and useful collections of their kind in North America (Glenister et al., 1977). The paleobotany collections at Field Museum rank fourth or fifth in size nationally with about 77,800 curated specimens that range in geologic age from Precambrian to Pleistocene.

Fossil Mammals: Collections

The Fossil Mammal Collection at The Field Museum is an important national and international systematic and paleontological resource, totaling more than 60,000 catalogued specimens. Since 1981 these collections have grown by 20,000 specimens (50%), almost all of which were added through the activities of Field Museum staff and associates, with contributions from other professionals and the public. Among the Vertebrate Paleontology subareas, The Field Museum Fossil Mammal Collection is among the largest, most active, and most significant in the United States (this collection is the largest of the Museum's Vertebrate Paleontology collections, together ranked fourth in size in the United States, with several collections of international importance). There are more than 300 references (more than fifty in the past ten years) in our partial tabulation of papers referring to specimens in the collection. This collection contains more than 60,000 catalogued specimen numbers (each catalogue number represents 1-10 or more individual specimens, as early collections often included more than one specimen under a single number), and more than 10,000 uncatalogued specimens (primarily in the Middle East and Australian Pleistocene collections). Since 1981 it has grown by over 50%, or about 3% per year.

Systematic Coverage--Most major groups of Mammaliamorpha and Mammalia (especially Theria) are well represented. Particular strengths include Mesozoic mammals, marsupials, edentates, carnivorans, rodents, early primates, insectivores, and most ungulate groups.

Geographic Strengths--Central and South America, North America (especially Colorado, Illinois, Montana, Nebraska, South Dakota, Texas, Wyoming), Australia, and the Middle East.

Type Specimens--There are more than 75 holotypes and 50 paratypes in the Fossil Mammal Collection.

Tertiary of North America--These collections are mainly from the Rocky Mountain states, where late Paleocene and early-late Eocene faunas from Colorado, Texas, and Wyoming are noteworthy and are actively growing through J. Flynn's collecting efforts in the Bridger and Washakie Basins of southwest Wyoming. The collections of late Eocene-Miocene faunas of Nebraska, South Dakota and Wyoming are classic, and are being augmented by new collecting of Research Associate Michael Parrish and his students at Northern Illinois University, and University of Chicago graduate students.

Cretaceous of Texas--The Trinity Cretaceous collection built by B. Patterson remains The Field Museum's most important Mesozoic mammal assemblage, and has been augmented through later collecting by W. Turnbull, J. Flynn, Research Associate Cathy Forster, and Ray Rogers (Cornell College). University of Chicago graduate students R. Blob and M. Carrano are making significant microvertebrate collections from the late Cretaceous of Montana.

Late Tertiary-Pleistocene of North America--This varied, but extensive, collection is quite good, with broad geographic and temporal coverage. It includes important Miocene and Pliocene collections from throughout the United States, an important late Miocene fauna from Honduras, a collection of La Brea Pleistocene mammals, and both regional and national Pleistocene collections.

Tertiary and Pleistocene of South America--This is one of the most significant elements of The Field Museum Fossil Mammal Collection, and it is one of the finest and broadest collections of South American Fossil Mammals housed anywhere in the world. The great majority of the collection was made by Elmer Riggs during three field seasons in Argentina and Bolivia in the 1920's. It has been augmented subsequently by new material and cast exchanges, by Patterson, Turnbull, Larry Marshall, Kubet Luchterhand (Research Associate, working in Colombia), and Flynn. Flynn has received support from NSF and other organizations for collection, preparation and research on exciting new faunas from South America.

Latest Tertiary and Pleistocene of Australia--This extensive and important collection of material from Madura Cave (Western Australia), the Limeburner's Point and Hamilton faunas (Victoria), and the Pilbara and Danning Basins, was made during the 1950's-1970's by William Turnbull and Research Associate Ernest Lundelius. Turnbull and co-authors published a series of monographs (seven parts) on the Madura Cave fauna, and twelve papers on the other faunas.

Quaternary of the Middle East--Several collections of material associated with archaeological sites in the Middle East (sites such as Palegawra Cave, Jarmo, and Warwasi; primarily in Iraq and Iran, but also Jordan and Turkey), form the core of a large and important element of the Fossil Mammal Collection. Most were collected by Robert J. Braidwood, Oriental Institute, University of Chicago. The earliest evidence of domestication of many mammals are documented in these collections. Additional Middle East material now housed in Anthropology and Zoology will be integrated into the Fossil Mammal collections facility in the future.

Endocast Collection--Former Research Associate Len Radinsky's exceptional collection of recent and fossil brain endocasts was donated to The Field Museum after his death. More than 500 fossil endocasts are currently curated and inventoried on the computerized database.

Madagascar Mesozoic-Pleistocene collections--Flynn and other Field Museum staff have established a collaborative "Accord" with the University of Antananarivo, Madagascar. This international research and Malagasy student training program will yield significant material for The Field Museum Fossil Mammal Collection, as the "Accord" includes a specimen sharing agreement; S. Goodman currently is in Madagascar making and curating collections of Pleistocene-subrecent fossil mammals for Field Museum. David Krause (SUNY-Stony Brook) and colleagues have initiated a major collecting and research program in Madagascar, which has yielded the island's first Mesozoic mammal (with more mammal specimens found in 1995), as well as abundant reptile, amphibian, and invertebrate fossils. This material will be housed at Field Museum. The combination of material from these two programs will make The Field Museum collection of Madagascar fossil mammals one of the most important in the world.

Fossil Fishes: Collections
The fossil fish collection is the first or second largest in North America, and one of the world's top four. It contains about thirty thousand specimen numbers, but because fossil fishes are frequently preserved in mass mortalities, the number of individuals in the collection is much higher. Specimen PF9668, for example, is a slab of limestone with over 200 nearly complete articulated skeletons. The Field Museum fossil fish collection contains representatives of over 250 families and well over 1,000 nominal species. The collection is worldwide in geographic scope, and contains material from the Early Ordovician (500 million years before present) through the Pleistocene (1-2 thousand years old). The collection includes not only fish fossils from most of the major, well-known fossil fish deposits of the world (Solnhofen, Monte Bolca, Mount Lebanon, Green River Formation, Niobrara Formation, etc.), but also many unusual elements. Of the thirty thousand specimens, about 65% are cataloged. Major strengths are: Mesozoic and Cenozoic ray-finned fishes, Silurian and Devonian jawless fishes, lungfishes, coelacanths, and placoderms (mostly from western North America), and Pennsylvanian chondrichthyans (sharks and kin) and paleoniscoids from the black shales of Indiana and Illinois.

Type specimens--The collection contains about 200 holotypes and hundreds, perhaps thousands, of paratype and figured specimens.

Systematic Coverage--Most major groups are well-represented, with particular strengths in Actinopterygii, Sarcopterygii, Iniopterygii, as well as various extinct Paleozoic shark groups and placoderms.

Geographic Strengths-- The collections are particularly strong in material from western North America, including Canada and Mexico, as well as Brazil, the Middle East, and Europe, with some coverage of Asia, Antarctica, Australia, and Africa.

Pennsylvanian Age Fishes--The Pennsylvanian Collection (approximately 4,000 specimens) is recognized by many paleoichthyologists as one of the world's most important Paleozoic fish collections. Mostly chondrichthyans and paleoniscoids, it includes the country's largest collection (over 1,200 specimens) of nearly complete, articulated chondrichthyan skeletons from the Paleozoic, and contains several undescribed taxa and unique examples of fine preservation. Most of these specimens were obtained from Indiana and Illinois (localities listed in Zangerl and Case, 1973) by Zangerl during the last thirty years, and some of his localities, as well as other Pennsylvanian sites represented in the collection, can no longer be collected.

Eocene Freshwater Fishes from North America--We have, by far, the world's largest collection of this material. This is a collection of several thousand specimens, and includes the most comprehensive data on the early development of the modern-day North American fish fauna.

Cretaceous fishes--This is one of the largest collections of Cretaceous fishes including premier collections from Brazil, Israel, Lebanon, Mexico, and the United States, and also smaller collections from Antarctica, Europe, South Yemen and Australia. Many of these pieces are "acid-transfer"-prepared, with preservation rivaling that of osteological preparations of living species.

Devonian Fishes--Amassed primarily by Curator R. Denison, the collection of Devonian fishes contains well over 1,000 specimens. Most of these are from North America (e.g., Wyoming and Ontario), but we also have strengths in Devonian fishes from Scotland.

Fossil Reptiles and Amphibians: Collections
The Field Museum's collection of fossil amphibians and reptiles comprises 5,825 catalogued specimens. The collection is concentrated in the North American Paleozoic, especially the Early Permian. Particularly important holdings are enumerated below.

Type Specimens--The collection includes 146 holotypes and 471 paratypes.

Systematic Coverage--Most major groups of Paleozoic amphibians and reptiles are represented in the collections, notably those from the Early Permian and Late Mississippian. Other groups with significant representation include turtles from the Tertiary, Triassic marine reptiles, Cretaceous dinosaurs, and Tertiary birds.

Geographic Strengths--The collections' primary strength is North American material, especially Early Permian of Texas and Oklahoma; Late Mississippian of Iowa; Middle Triassic of Nevada.

Early Permian--The core of our Early Permian holdings is represented by the Walker Museum collection, which was transferred here from the University of Chicago. It and our other Early Permian collections come mostly from Texas and Oklahoma, with some important specimens from New Mexico. This part of the collection represents the research efforts over nearly 100 years of some of the best known workers in early tetrapod systematics, including A. S. Romer, Everett Olson, and their numerous students. It is relatively well studied, and rich in type and figured specimens. Major additions to our Early Permian holdings within the last 20 years are primarily from Oklahoma, and due to the work of both Everett Olson (then at the University of Chicago) and some of his students, and J. Bolt (as a student at the University of Chicago, and later as a curator at Field Museum). Bolt's activities in particular have resulted in addition of many exquisitely preserved specimens of small tetrapods from a fissure-fill system in southwest Oklahoma.

Fossil turtles--Fossil turtles, most collected from the Tertiary of Wyoming are a significant area of the collection, and largely due to the work of Rainer Zangerl.

Dinosaurs--The dinosaur collection includes mostly Cretaceous specimens (tyrannosaurids, hadrosaurs, ceratopsians) from both the United States west and Canada (the well-known mounts of *Albertasaurus* and *Lambeosaurus*). The most important Jurassic dinosaur material is a (composite) mounted specimen of *Apatosaurus*, currently on display in "DNA to Dinosaurs," and the holotype of *Brachiosaurus* on display in Stanley Field Hall. Recent additions of therapod material includes *Cryolophosaurus*, a Jurassic dinosaur recently discovered in Antarctica by Research Associate Bill Hammer. Ongoing work in Madagascar by Research Associates Dave Krause and Cathy Forster, Field Museum's G. Buckley, Malagasy and other colleagues is yielding new material of dinosaurs, birds, crocodiles and other reptiles.

Marine Middle Triassic reptiles--O. Rieppel's ongoing field program in the Middle Triassic marine deposits of northwestern Nevada have resulted in significant discoveries of marine Middle Triassic reptiles. Specimens collected represent the only Triassic stem-group Sauropterygia known from the New World (other than the enigmatic genus *Corosaurus* from Wyoming).

Mississippian amphibians--A remarkable assemblage of Mississipian amphibian material was collected within the last 10 years by crews directed by J. Bolt, all from a single locality in southwestern Iowa. This site, a sinkhole some 16 meters in diameter, was probably a pond during the Later Mississippian. It has produced hundreds of tetrapod specimens; many are very well preserved and some are nearly complete. This locality was the first reported occurrence in midcontinental North America of Mississippian tetrapods (the continent's oldest), and is one of no more than two dozen such localities in the world.

Fossil Invertebrates: Collections

The Fossil Invertebrate collection constitutes a national resource that is ranked third in the size of its holdings and third among the most significant and useful collections of its kind in North America. The collection includes classic material from the former Walker Museum of the University of Chicago , including historically significant collections by Weller, Hall and others. Collection size is estimated at 320,000 specimen lots made up of as many as two million individual specimens. The collection spans the geologic column from Precambrian to Holocene with representatives from all the continents. The collection is rich in population and community samples by which variability, growth and environmental associations of the past may be assessed. During the past 25 years, there has been a constant effort to upgrade the quality and representation of the collection through new acquisitions.

Type specimens--Approximately 3,500 specimens are primary types and an additional 15,000 are secondary types.

Systematic Coverage--The collection includes examples of all the classes and nearly all the orders of invertebrate life found in the fossil record.

Geographic Strengths--The collection's primary strength lies in materials from North America, notably the Paleozoic of the Mississippi Valley. Areas of key significance are listed more fully below.

Paleozoic of the Mississippi Valley--The collection of fossil invertebrates includes the most extensive representation of the Paleozoic of the Mississippi Valley; there are no other comparable collections. Particularly important are Ordovician through Pennsylvanian fossils from the margins of the Illinois Basin. Among the most significant materials are: Ordovician limestone faunas, Mississippi Valley; Silurian reef and interreef faunas of Illinois and Wisconsin; sponges of Tennessee; Devonian falls of the Ohio, especially corals, brachiopods, bryozoans; Mississippian faunas of the Mississippi Valley; crinoids and trilobites from Crawfordsville, Indiana; Pennsylvanian Mazon Creek (see below) and Mecca Faunas (currently the most active collection); and Receptaculitids from the Ordovician and Silurian (the most important collection worldwide).

Mazon Creek--The Mazon Creek assemblage of fossil animals and plants is unique in its remarkable preservation of a 300 million year old marine and terrestrial biota, and it is one of only a handful of similar occurrences known from the geological record. The Field Museum collections are the definitive resource for the study of the Mazon Creek Biota.

New acquisitions--Several important collections of excellent Paleozoic and Cretaceous fossil invertebrate material are slated for accession. Among them is a collection documenting the early diversification of echinoderms in the Ordovician, currently being studied by Research Associate T. Guensberg (Rock Valley College) and J. Sprinkle (University of Texas), Mississippian Bryozoa collected and studied by Research Associate F. McKinney (Appalachian State University), and rare Mazon Creek taxa including an undescribed arachnid and several Pennsylvanian insects collected by R. Masek (Field Museum) and studied in part by J. Kukalova-Peck (Carleton University). The largest lot of material to be accessioned is a collection of Campanian, Maastrichtian and Danian invertebrates from Madagascar, collected by Buckley, Joe Hartman and others in 1993 and 1995. Additional material from Madagascar is expected to be collected in 1996, and commitments to study this material have already been made by a number of specialists.

Fossil Plants: Collections

The paleobotany collections at Field Museum rank fourth or fifth in size nationally with about 77,800 curated specimens that range in geologic age from Precambrian to Pleistocene. The paleobotanical collections at The Field Museum are an important national and international resource for systematic and evolutionary plant biology. In the past five years these collections have grown by over 10% (ca. 7,800 specimens). Of the recent acquisitions, ca. 41% were added through the activities of Field Museum staff and associates, and ca. 59% were added through the acquisition of scientifically important donated collections. Active field work by Field Museum staff, associates, and students during this period has resulted in steady growth of the paleobotanical collection.

Type Specimens--Approximately 1,200 specimens of fossil plants have been designated as types, or figured in publications by scientists from The Field Museum and other institutions. Type and figured paleobotanical specimens are housed separately from the general collection and are organized by publication.

Systematic Coverage--Most groups of plants are well-represented in the paleobotanical collections. Particular strengths include a wide array of Carboniferous taxa, and Cretaceous and Paleogene angiosperms.

Geographic Strengths--The paleobotanical collections possess nearly worldwide coverage, but are strongest for North American localities. Within North America the collections are especially strong in Paleozoic material from Illinois, Indiana, Iowa, Michigan, Ohio, and West Virginia, Mesozoic material from Alaska, Utah, Virginia, Maryland, Georgia, and Tennessee, and Cenozoic material from

Mississippi, Tennessee, North Dakota, Wyoming, Montana, and Colorado. Especially significant localities are described below.

Mazon Creek Flora--One of the greatest strengths of the paleobotanical collection is the Pennsylvanian Mazon Creek flora, a collection of 23,907 fossil plant specimens. The Mazon Creek assemblage was the subject of an NSF facilities grant that supported curatorial improvements to this unique collection. One important result of these activities is that 455 type and figured fossil plant specimens from Mazon Creek have been identified and removed to the type and figured collection.

Paleocene of the Rocky Mountain and Great Plains--The paleobotany holdings at Field Museum are also particularly strong in the Paleocene of the Rocky Mountain and Great Plains area. The bulk of this collection derives from field activities by Crane, Herendeen and others in North Dakota, Montana, and Wyoming, where in the past ten years approximately 5,350 fossil plant specimens have been collected, primarily from two localities, Almont and Melville. The most significant of these localities is that near Almont, North Dakota, where a laterally restricted outcrop of shale belonging to the upper Paleocene Sentinel Butte Formation has yielded approximately 3,500 specimens, from which 65 types of fossil leaves, fruits, seeds, and stems belonging to 30-45 species have been identified (Crane et al., 1990). This Paleocene flora is particularly significant both because it is diverse (as compared to other assemblages of similar age) and because many specimens are silicified and anatomically well-preserved (e.g., Crane et al., 1990, 1991).

Mid - and Late Cretaceous of Eastern North America--Recent field work by Crane and Herendeen and colleagues in the mid-Cretaceous Potomac Group and Late Cretaceous of the southern Atlantic Coastal Plain of eastern North America has generated a large collection of fossil angiosperm, gymnosperm, and pteridophyte material. Fossil plant materials from the Atlantic Coastal Plain are isolated from unconsolidated sediments by sieving and are exceptionally well preserved. Specimens are mummified and fusainized and are providing a wealth of information about the morphology and anatomy of Cretaceous plants (e.g., Crane and Upchurch, 1987; Crane et al., 1989, 1993, 1994; Srinivasan and Friis, 1989; Drinnan et al., 1990, 1991; Herendeen, 1991a,b; Pedersen et al., 1991, 1994; Herendeen et al., 1993, 1994, 1995; Srinivasan, 1992). Although the fossil angiosperms remain the focus of active ongoing research and are being actively curated in concert with the research effort, the abundant gymnosperm , pteridophyte and bryophyte material is equally significant (e.g., Srinivasan and Friis, 1989; Srinivasan, 1992).

Recent acquisitions--Two large paleobotanical collections have recently been added to The Field Museum holdings. The larger of these collections, which numbers approximately 4,600 specimens, was given by Prof. A. T. Cross (Michigan State University). The Cross collection, which is extensively documented by field notes with precise locality and stratigraphic data, includes material from numerous North American and foreign localities from the Silurian through the Paleogene (Neogene collections were retained at Michigan State University). Of these localities several are particularly significant. A Middle Pennsylvanian locality from near Grand Ledge, Michigan, is a deltaic siltstone deposit in which fossil plants are abundant. The Grand Ledge collection comprises approx. 850 specimens of taxa such as *Megalopteris, Ginkgophyllum*, cordaite stems, leaves, and seeds of several types, and other reproductive structures (Cross et al., 1981). Another extensive collection made by A. T. Cross and colleagues is that from the Early Permian (Dunkard) of the Appalachian Plateau (Cross, 1984). The Dunkard flora, which comprises over 1,000 specimens of compression fossils in siltstones and shales, was extensively collected from numerous localities in West Virginia, southeastern Ohio, and western Pennsylvania. The Dunkard florules are generally dominated by Late Pennsylvanian species with Early Permian plants represented in lesser numbers. Other significant floras in the Cross collection include the Paleocene and Eocene of Alaska (ca. 360 specimens) and the Cretaceous of Wyoming and Utah (ca. 1,500 specimens). While the Cross collection is extensively documented by field notes, considerable curatorial work is required to improve the availability of these materials, and maximize their utility to the scientific community.

Physical Geology: Collections

There are approximately 63,000 specimens in the six physical geology collections (mineralogy, gems, petrology, sedimentary rock, economic geology, and meteorites).

Meteorites--The meteorite collection housed at The Field Museum is one of the largest and most representative in the world, and is an important resource for the international cosmochemical and planetary science community. There are roughly 2,611 known well-documented meteorites in the world; The Field Museum collection contain nearly 48% of these known meteorites, and ranks as one of the seven largest meteorite collections in the world. The collection contains approximately 2,388 meteorite samples with 3,499 meteorite specimens, including a valuable reference collection of polished and thin sections. The Field Museum collection contains useful specimens of 62.5% of all non-Antarctic meteorites, including representatives of all meteorite classes and sub-classes. Including the Antarctic meteorites, the collection has approximately 1,249 distinct meteorites: 405 iron meteorites, 44 stony-iron meteorites and 800 stone meteorites. The meteorite collection is one of the most active collections in the Geology Department in loan activity, with most loans for the purpose of research investigations and destructive analysis. A survey made by Research Associate L. Grossman (University of Chicago) showed that during the period 1978 - 1987, Field Museum meteorite specimens were used in 27% of specimen-based scientific papers published in the preeminent geochemical journal *Geochimica et Cosmochimica Acta*, with additional papers using Field Museum meteorite specimens published in *Meteoritics, Earth and Planetary Science Letters, Nature* and *Science*.

The collection is particularly strong in iron meteorites, and contains very large amounts of Murchison (a Type 2 carbonaceous chondrite and the first meteorite in which amino acids were discovered, in The Field Museum collection), Allende (a Type 3 carbonaceous chondrite), and Indarch (an enstatite chondrite). Two recently acquired meteorites (Peekskill and Axtell) were obtained by exchanges, and were studied and classified, resulting in two announcements in the *Meteoritical Bulletin* and *Meteoritics* journal, two abstracts and a paper. The purchase in 1996 of a new and previously unknown mesosiderite from Kansas marks a significant addition to the collection.

Mineralogy--The mineralogy collection of approximately 30,000 specimens contains a wide variety of mineral species and geographic occurrences, and is an important public education collection.

Gem Collection--Most of the Museum's small but significant collection of representative precious and semi-precious stones is on exhibit. The most significant specimen is a 62,000 carat single crystal of topaz, very light yellow, transparent, which has been described as "textbook quality." Recent donations of jewelry including diamond, ruby, sapphire, emerald, opal, jade and pearls have increased the variety and educational value of the collection.

Petrology--The petrology collection contains diverse rocks from all over the world. It is particularly strong in material from Vermont and the Black Hills of South Dakota, and there is a large collection of slates and weakly metamorphosed rocks from Pennsylvania, Michigan, Arkansas, Oklahoma, and Wales. Central American volcanic rocks, largely collected by S. K. Roy, are well represented.

Sedimentary rock--The sedimentary rock collection includes a significant assemblage of Lower Tertiary terrestrial rocks from the eastern front of the Rocky Mountains and Utah, useful in studies of paleoenvironments.

Economic Geology--The economic geology collection contains examples of most metallic and non-metallic ores from all over the world. The collection began with the vast number of specimens assembled for the World's Columbian Exposition in Chicago in 1893, later enhanced by materials from the Louisiana Purchase Exposition, 1904, the Panama-Pacific International Exposition, 1915, and the Alaska-Yukon-Pacific Exposition, 1909. Significant additions of South American specimens were made during the 1920s by O. C. Farrington and H. Nichols, and in 1962 with the acquisition of the E. S. Bastin collection of metallic ores from Canada, Mexico, and the western United States.

Petrographic Thin Sections--An important adjunct to the physical geology collections is the 2,700 petrographic thin sections of rocks, minerals and meteorites, which reflect the research interests of the staff and the external scientific community--particularly igneous and metamorphic rocks and concretions, and meteorites.

DEPARTMENT OF GEOLOGY - COLLECTION SIZE AND GROWTH

	1994 Number of Specimens	1995 Number of Specimens	1994-1995 % growth
Physical Geology	62,990	63,057	0.11
Invertebrate Paleontology	319,345	320,255	0.28
Plant Paleontology	63,057	63,111	0.09
Vertebrate Paleontology	78,876	81,506*	3.33
Geology Total	**524,268**	**527,929**	**0.70**

* catalogued specimens. Does not include approximately 25,000 uncatalogued specimens, reported as part of total specimens in prior years.

DEPARTMENT OF ZOOLOGY

Department of Zoology: History

The Department of Zoology traces its origin to the foundation of The Field Museum in 1893. At the inception of the department, its title "Department of Zoology, except Ornithology," reflected the existence of Ornithology as a separate department. Curator C. B. Cory had donated his collection of 19,000 bird specimens to the museum in exchange for departmental status for Ornithology, and his appointment as lifetime curator without residence obligations. The Department of Ornithology, with Curator Cory and Assistant Curators, G. K. Cherrie and N. Dearborn, remained separate for six years.

In this early period, Curator D. G. Elliot, an eminent ornithologist and mammalogist, led Zoology (except Ornithology) with Assistant Curators O. P. Hay and later S. E. Meek. Despite their specialty in ichthyology, both assistant curators worked in all non-ornithological fields of zoology. Meek's collections of Mexican and Central American Fishes made ichthyology a world-renown resource. The first Assistant Curator hired with responsibility for a specific animal group was W. J. Gerhard, appointed in Entomology in 1900.

Taxidermist C. Akeley was hired into the Department of Zoology in 1895. During Akeley's fourteen years with the Museum, he perfected his sculptural methods in taxidermy and created vivid depictions of animals in their natural habitats - an idea so beautifully executed at The Field Museum that it became the standard to which all museums aspired. However, Akeley was not the only pioneering taxidermist in Field Museum history; L. L. Walters, at the Museum for forty-three years beginning in 1911, perfected new techniques to prepare animals, such as amphibians and rhinoceroses, that could not be prepared with standard methods of the time.

In 1906, the loss of Cory's personal fortune left him unable to support his appointment in Ornithology, and when Elliot resigned to return to New York, Cory was named Curator of the newly-unified Department of Zoology - an appointment that lasted until his death in 1921. During this interval, Zoology flourished, assistant curators were appointed for the divisions of Osteology (E. N. Gueret in 1906), Mammalogy and Ornithology (W. H. Osgood in 1909), Ichthyology and Herpetology (C. L. Hubbs in 1916, replaced by A. C. Weed in 1920). The Division of Oology was created in 1917 around the bird egg collection donated by Judge R. M. Barnes. Barnes retained his appointment of absentee curator of the Division of Oology until his death in 1945, when the egg collection was incorporated into the Division of Birds.

The year 1921 brought several changes, among them Cory's death and the appointment of W. H. Osgood as Curator of Zoology. The names of the zoology divisions, Conchology (the only division without its own curator), Entomology, Herpetology, Ichthyology, and Mammalogy and Ornithology were anglicized in 1921 although Osteology remained unchanged. Mammalogy and Ornithology were also established as separate divisions. E. Heller became Assistant Curator of Mammals through 1927 and J. T. Zimmer took that role through 1930 in Birds. A. C. Weed focused on Fishes, and K. P. Schmidt became Assistant Curator of Reptiles and Amphibians the following year.

In 1922, C. E. Hellmayr was named the first Associate-level Curator in Zoology. Hellmayr's specialty in Neotropical birds was a major impetus to the development of what has now become a major international resource in that area at The Field Museum. C. B. Cory had begun what was to become the eleven-part, fifteen volume "The Catalogue of Birds of the Americas" in 1918; Hellmayr's task was to complete it, which he did in 1949, with the assistance of C. B. Conover. With Osgood's guidance, Conover had developed from a wealthy young sportsman to a scientific ornithologist, who not only contributed to the completion of the Catalogue, but earned the status "Benefactor" through his long relationship with The Field Museum. The donation of his personal bird collection increased the Museum's holdings dramatically and, through his efforts, "The Catalogue of Birds of the Americas" remains a basic taxonomic text.

In the 1920's, Field Museum collections grew as museum expeditions to Africa, South America and the Pacific led by staff from Birds, Mammals and Amphibians and Reptiles, as well as individuals such as

Captain Marshall Field, members of the Roosevelt family and Conover, returned with scientific specimens. The expeditions increasingly focused on building research collections rather than collections solely for public exhibits.

Expeditions continued at a reduced pace during the 1930's. Schmidt traveled to Guatemala and Peru to collect specimens. The curator of Birds, W. R. Boulton from 1931-1946 collected in West Africa, Angola and the Kalahari Desert. In 1935, E. Blake, hired as Assistant Curator of Birds, furthered the collections of Neotropical birds through trips to South America.

In 1936, changes in curatorial titles reflected increasing scientific professionalism among museum staff. The Curator of Zoology became the "Chief Curator," Assistant Curators became Curators, and Assistants, including E. R. Blake in Birds and D. D. Davis in Osteology (renamed Vertebrate Skeletons), became Assistant Curators. During the depths of the Great Depression, the Workers' Progress Administration (WPA) funded additional positions at the museum, which resulted in dramatic increases in curatorial activity.

In 1938, F. Haas, a researcher renowned for his study of fresh-water mollusks, had fled Nazi Germany, and was appointed as Curator of Lower Invertebrates. Haas' efforts extended beyond his scientific research to opening the crates of invertebrate specimens that had been closed after the 1893 World Columbian Exposition. These specimens, representing a frequently over-looked aspect of animal diversity, were re-identified, rehoused, and catalogued to form the foundation of what has become a world-class collection of invertebrates, with a strong emphasis on mollusks. The second Assistant Curator of Insects at The Field Museum was J. E. Lijebland, appointed to join W. J. Gerhard in 1936. Lijebland was replaced by R. Wenzel in 1940. Wenzel, who retired in 1981, continues to serve The Field Museum as an active Curator Emeritus. In 1941, H. S. Dybas joined the staff as an assistant, and moved to Assistant Curator status in 1946. Dybas retired and became Curator Emeritus in 1980.

With W. H. Osgood's retirement from duties of Chief Curator of Zoology in 1940, K. P. Schmidt served in that position for the next fifteen years. Schmidt's promotion opened a position in Reptiles that was filled by C. H. Pope. In Fishes, L. P. Woods was hired as Assistant Curator in 1941. His career at The Field Museum, despite interruptions during the 1940's, would last through 1978, and produced significant growth of both the freshwater and marine fish collections. During World War II, many museum careers were suspended as staff participated in the war efforts. The volunteers in the Bird division and Ellen Thorne Smith, founder of the Women's Board, and Marion Grey in the Fish Division, were practically the only staff in their divisions during these years.

In 1946, R. F. Inger began working as a part-time assistant in the Division of Amphibians and Reptiles while he conducted his doctoral research. He was appointed Assistant Curator of Fishes in 1949, and continued in that position until 1953. P. Hershkovitz was appointed as Assistant Curator of Mammals in 1947; he became Curator in 1956 and Research Curator in 1962. H. Hoogstraal was Assistant Curator of Insects from 1947-48. Hoogstraal continued a strong association with the museum through his field collections for many divisions. In 1955, Schmidt was the first member of the Museum staff elected to the National Academy of Sciences.

A. L. Rand served as Curator of birds from 1947 until 1955, when on Schmidt's retirement, he became Chief Curator of Zoology. H. Marx was appointed as assistant in the Division of Amphibians and Reptiles in 1949, became Assistant Curator in 1960, and moved through the curatorial ranks to become Curator in 1973.

After fifty years in the Insect Division, Curator Gerhard retired to become Curator Emeritus in 1950. Rand became Chief Curator of Zoology in 1955, holding that post until 1970. Inger succeeded Pope as Curator of Amphibians and Reptiles in 1954. In 1956, M. Traylor became Assistant Curator of Birds, appointed in recognition of his contributions to the division since 1937 as an expedition collector and unpaid associate. Despite his retirement in 1980, Traylor continues his work as Curator Emeritus.

A. Solem was appointed in 1956 as Assistant Curator of Invertebrates, sharing duties of the Invertebrate Division with Haas until Haas retired in 1958. Solem, an exceptionally productive researcher, built large collections of land snails, especially from Australia. J. Moore served as Curator of Mammals from 1961-1971.

K. P. Schmidt's retirement ended prematurely on September 26, 1957 when he was bitten by a poisonous snake that had been brought to The Field Museum for identification. Schmidt disregarded the seriousness of the bite of the juvenile boomslang (*Dispholidus typus*) and did not try to counteract the effects of the venom. The notes he made on the progression of his symptoms were published in a posthumous scientific paper.

The Department of Zoology achieved its current form - in which all specimens of a group are maintained within a single division - in 1972. After D. Davis' 1964 retirement, K. F. Liem had taken charge of the Division of Vertebrate Skeletons, the final incarnation of Osteology, previously Anatomy and Osteology (and Vertebrate Anatomy). Liem's acceptance of a position at the Museum of Comparative Zoology at Harvard resulted in the division being dissolved and its collections dispersed to their taxonomically appropriate divisions. Around this time, the administrative head of the Zoology Department changed from that of Chief Curator to a Chairman who is elected from among the curatorial staff.

Additions to the curatorial staff in the 1970's included R. K. Johnson, who rose to the rank of Curator and was Department Chair from 1980-1986. J. Kethley appointed as Assistant Curator in 1970, is currently Curator of Insects. Inger left the Division of Amphibians and Reptiles to become Chairman of Scientific Programs for the Museum and later Assistant Director of Science and Education, returning in 1978 to his curatorial position. H. K. Voris joined Zoology in 1973 as Assistant Curator of Amphibians and Reptiles. He later served the Museum as Assistant to the Director of The Field Museum (1983-84), and Vice President of Collections and Research (1985-89), returning to a curatorial role in 1989. D. J. Stewart was Assistant Curator of Fishes from 1978-1985. J. W. Fitzpatrick curated Birds from 1978 to 1989, and was later Department Chair.

Several of the current curatorial staff joined the Zoology department in the 1980's: including Curator of Mammals, B. Patterson in 1981; Associate Curator of Insects, A. Newton in 1985; Associate Curator of Fishes, B. Chernoff in 1987 (currently Department Chairman); and Associate Curator of Mammals, L. Heaney in 1988. Also appointed in the Division of Insects were L. Watrous (1980-1984) and S. Ashe (1982-1988). S. M. Lanyon was appointed as Assistant Curator of Birds in 1985, and served as Chair from 1990-1993. Lanyon was instrumental in establishing the shared interdepartmental Biochemistry Laboratories at The Field Museum.

Changes in Zoology at The Field Museum in the 1990s have kept pace with rapid advances in zoological science. The sudden death of A. Solem in 1990 prompted the department to strengthen its commitment to invertebrate zoology by appointing R. Bieler and J. Voight as the first marine malacologists in Field Museum history. M. Westneat's appointment as Assistant Curator of Fishes in 1991 added a component of functional morphology to specialties represented among the staff. The appointment in 1995 of Assistant Curators J. W. O. Ballard (Insects), S. Hackett and J. Bates (Birds) and A. Graybeal (Amphibians and Reptiles) bring new research strengths and increased breadth to the Department.

Department of Zoology: Research

The Department of Zoology is the largest of the Museum's four curatorial departments and is currently organized into six divisions: Amphibians and Reptiles, Birds, Fishes, Insects, Invertebrates, and Mammals.

Amphibians and Reptiles: Research

Extensive field work since 1950 in Southeast Asia by R. F. Inger has led to systematic works on the herpetofauna of tropical Asia, with emphasis on the Bornean fauna. These studies, involving both Inger and H. K. Voris, include analysis of relative abundances over atwenty-two-year period at a single Bornean site, and regional diversity of the herpetofauna of Borneo. Two new projects were recently initiated: variation in sequence of changes at metamorphosis in Bornean tadpoles; and relative size and spatial relations of viscera in Bornean tadpoles. H. K. Voris continues his research on the ecology of marine snakes. In collaboration with faculty and students at the University of Malaysia, Sabah campus, he has initiated mark and recapture and thermoregulatory studies on sea snake populations off the coast of Borneo (Sabah, Malaysia). He also continues studies with research associates W. B. Jeffries and C. M. Yang on the coevolutionary relationships between barnacles and sea snakes and decapod crustaceans found in the sea adjacent to Singapore. A. Graybeal's interests focus on the evolution of diversity, both macroevolutionary (patterns of character evolution, biogeography) and microevolutionary (population differentiation and speciation). She addresses these topics using the large frog family Bufonidae (True Toads) because these organisms display interesting patterns of similarity and differentiation, hybridization, and geographical distribution. Her principle source of data is molecular (primarily DNA sequences), though she also works with morphological characters. While the main goal is to use genetic sequences to determine phylogenetic relationships among the toad species and subsequently interpret patterns of character evolution and biogeographical radiation, she maintains a strong interest and curiosity regarding the various aspects of this analytical process, including how to achieve and evaluate support for particular relationships, how to evaluate the phylogenetic utility of genetic sequences, etc., and pursues side projects on these topics. Her microevolutionary research is beginning with a study of speciation of North American toads. She is obtaining DNA sequences from various genes and is using coalescent methods to explore different microevolutionary processes that may affect or be symptomatic of speciation. These data will also be used to provide empirical insight into current debates over species concepts.

Birds: Research

S. Hackett and J. Bates both work on the systematics and biogeography of Neotropical birds. Bates works mainly at lower taxonomic levels studying the genetic structure of bird species distributed in South America. He is also continuing research investigating the genetic consequences of habitat fragmentation. S. Hackett conducts systematic research at higher taxonomic levels: species, generic, familial. Currently , she is continuing a systematic project on the avian family Pipridae, where she is studying genetic, syringeal, behavioral, and plumage evolution, and biogeography. D. E. Willard conducts research on distribution of East African montane birds and on the demography and morphometrics of Illinois migrants. M. A. Traylor, Jr., continues working on the systematics of South American birds. E. R. Blake works toward completion of the second volume of his Manual of Neotropic Birds.

Fishes: Research

B. Chernoff's research has emphasized the systematics and phylogenetic relationships of silverside fishes of the world, and choriciform fishes from the freshwaters of South America. He has long term collaboration with Dr. Antonio Machado-Allison, Universidad Central de Venezuela, to study the systematics and biogeography of Venezuelan freshwater fishes. His other research includes studies of morphological evaluation and the theory and methods associated with systematic biology. M. Westneat's research combines functional morphology with phylogenetic systematics. The biomechanics of feeding and locomotion in fishes are of particular interest. Techniques include high-speed video analysis of the behavior of living animals, descriptive morphology, and physiological measurements of muscle activity. Functional hypotheses are tested with a combination of laboratory experimentation and field work in the coral reef habitat of the fishes. His evolutionary research involves studying the anatomy of the labrid fishes, one of the most diverse fish families on coral reefs throughout the world. Studying these fishes involves collecting expeditions to tropical coral reefs in Australia, the Coral Sea, and Thailand.

Insects: Research

J. Kethley's research involves phylogenetic analysis of comparative developmental data for soil mites living in nutrient-poor ecosystems such as very sandy soils. The goal is to contribute to an understanding of the evolution of chelicerate terrestrialization and soil mite community structure. W. Ballard's research strives to unite evolutionary pattern and process by using phylogenetics to infer change. Ballard's current research focuses on cospeciation: of bats and their fly parasites, and of a rickettsial parasite with its arthropod hosts. A. Newton's research focuses on the systematics and evolution of the beetle superfamily Staphylinoidea; recent contributions include a review of the classification of all beetle families and subfamilies (with J. Lawrence of CSIRO, Australia) and the discovery of a "missing link" that resulted in the merging of two staphylinoid beetle families to form one of the largest insect families with over 42,000 known species (with M. Thayer). Newton and Thayer also collaborate on a long-term study of the systematics and biogeography of the poorly-known fauna of these beetles in the southern hemisphere; their recent field work in Australia has produced over 400,000 adults and larvae, half of which represent unnamed species. The southern temperate work is part of M. Thayer's interest in systematics, evolution, and biogeography of world rove beetles, especially the more basal lineages. Her ongoing studies of the worldwide tribe Omaliini will provide a phylogenetic background for evolutionary studies of their biogeography and feeding habits; the latter are unusually diverse among rove beetles. She has recently begun studying the rove beetle fauna of the Chicago region as part of the museum's efforts to increase knowledge of this rich area's biodiversity and provide data for use in land management decisions. Under contract to the National Biological Service, Thayer is also coordinating assembly of a database of all names that have been used for the roughly 25,000 beetle species of the United States and Canada. P. Sierwald's research focuses on the systematics and biogeography of the large worldwide spider family Pisauridae. Currently, the investigations concentrate on African and Malagasy members of the family. A second project is underway, focusing on mating behavior, sexual selection and evolution of mating systems in widow spiders. A third long-term project is an investigation into the ontogenetic development and evolution of complex female genitalia in spiders. Long-term studies on the systematics and biogeography of other insect groups continue by H. Nelson on dryopoid water beetles (with recent field work in eastern Asia), R. Wenzel on histerid beetles and batflies, and P. Parrillo on scaritine ground beetles.

Invertebrates: Research

Historically, the research emphasis of the staff has been systematic malacology, spanning land, freshwater and marine molluscan taxa with successive curatorial appointments. Founding curator Haas built and used a large collection of freshwater taxa. He published 319 titles and described nearly 400 new genera and species over a sixty-year career at Senckenberg Museum and The Field Museum. Solem's research focused on the Pacific Basin, Neotropical, and Australian land snail fauna and how they are related to faunas of other area, the overall phylogeny of land mollusks, shifts in feeding patterns and structure, and overall reproductive strategies of snails living in semi-arid zones. He published 140 scientific papers plus many popular articles while at Field Museum. R. Bieler's research concentrates on gastropod phylogeny, employing a variety of techniques ranging from marine field work to gene sequencing and fine-histological techniques in the newly established histology laboratory. He also continues projects dealing with the phylogeny of sessile marine snails and of marine gastropod groups with long-distance dispersal abilities. J. R. Voight studies the evolution and ecology of cephalopod mollusks, with an emphasis on octopuses. To learn more about the animals and their habitats, Voight analyzes their anatomy and morphology to discover characters that reveal the animals' phylogenetic relationships. Many forms of little-known octopuses live in the water-column, as do squids, although most familiar are bottom-dwelling octopuses. Understanding how these benthic octopuses came to occur throughout the world's oceans, from the intertidal zone to hydrothermal vents at great depths, is one goal of her research.

Mammals: Research

L. R. Heaney is continuing his investigation of the evolution and ecology of mammals in island ecosystems on a wide range of issues, including systematics, biogeography, population ecology, and genetics; this research is carried out in North America and especially in Southeast Asia. He is also increasingly active in issues involving conservation of biological diversity. B. D. Patterson's main focus is on the ecology, evolution, and distribution of the mammals of Central and South America. His work on rodent evolution and conservation in the face of environmental change have recently added tropical Africa and Madagascar to his long-term interests in the Andes Mountains and Amazon Basin. P. Hershkovitz is continuing his landmark studies of Neotropical mammals, with studies of the small mammals of eastern Brazil that he and colleagues obtained in the 1980s and early 1990s. Despite the depauperization and massive habitat destruction in the Atlantic coastal forest of Brazil, he has continued to discover new mammalian species and genera. W. T. Stanley is studying the biogeography and ecology of small mammals in montane areas of East Africa, with particular emphasis on the fauna of the Eastern Arc Mountains of Tanzania. S. M. Goodman is studying the living and fossil mammals and birds of Madagascar, making remarkable new discoveries of species, documenting patterns of biological diversity, and providing advanced training to Malagasy graduate students in systematics, ecology, and conservation biology. J. C. Kerbis is investigating the biogeography and systematics of African small mammals, particularly those on mountaintops astride the Albertine Rift in Central Africa. J. Fooden conducts revisionary studies of macaques and other tropical Asian monkeys, while R. H. Pine continues his research on the systematics of Neotropical mammals.

Department of Zoology: Collections

Division of Amphibians and Reptiles: Collections

A separate Division of Amphibians and Reptiles was established at The Field Museum in 1921. Prior to that time, the ichthyology and herpetology collections had been administered by the same curators. The arrival of Karl Patterson Schmidt in 1922, as the first curator of the Division, signaled the beginning of significant expansion of the collection in terms of size, geographic scope, and taxonomic diversity. When Schmidt's tenure began, the herpetology collection consisted of less than 8,000 specimens, representing approximately 3,245 catalog entries. By 1941 when he became Chief Curator of Zoology, the collection had increased to about 50,000 specimens representing 36,612 catalog entries. The collection currently contains over 265,000 specimens and 251,715 catalog entries, an increase of 264% over the past forty-five years. Amphibians represent 138,976 catalog entries (55% of all entries) and reptiles represent 112,739 catalog entries (45% of all entries). The bulk of the collection is preserved in fluid (98%) and stored in more than 23,500 jars and 160 stainless steel tanks.

The collection serves as a major research resource for the national and international scientific community, and contains unique material of special historical and ecological significance. It has been recognized as one of the five largest and most representative collections of amphibians and reptiles in the United States (Wake et al. 1975). Collection use has been growing steadily. Loan requests, visits by researchers, and information requests are at or near record levels.

A substantial portion of the growth of the collection was the result of The Field programs of past and current curators. Karl P. Schmidt conducted fieldwork in Brazil, Argentina, Uruguay, Peru, Chile, Galapagos Islands, Guatemala, Panama, Belize, Honduras, Mexico, West Indies, Arizona, Texas, Illinois, and the islands of the Pacific. Clifford H. Pope's field efforts, while at The Field Museum, were directed towards plethodontid salamanders in Mexico, California, and the eastern United States. By contrast, Robert F. Inger and Harold K. Voris have conducted their field programs in the Old World, specifically Asia and the Indo-Australian region. However, strategic purchases, long-standing open exchange programs, sponsorship of field collectors, and networking, particularly by Curator Emeritus Hymen Marx, which resulted in the donation of substantial collections, have added to the depth and breadth of divisional holdings. Significant accessions, measured in terms of quantity and quality, include Inger's Bornean material, Voris' hydrophiid material, the Harry Hoogstraal collections from East Africa through Turkey, the Sherman C. Bishop collection (including the University of Rochester collection), and the massive Edward H. Taylor collection. The Edward H. Taylor collection was the single, largest collection received from an external source. This 35,000-specimen collection, which included material from Mexico, Costa Rica, the Philippines, Thailand, Liberia, and Kansas, added to the taxonomic, geographic, and typic diversity of the Division's collection. Of particular note is that Taylor, Hobart M. Smith, and others published extensively on large parts of this collection.

The entire herpetological collection was moved from the third floor to the present ground floor location in 1952 and 1953. Serious overcrowding due to tremendous increases in the size of the collection necessitated the initial move from the third floor and three separate ground floor expansions beginning in the late 1970's. With the last expansion in 1994, sufficient space for satisfactory housing of the existing collections and a comfortable measure of expansion potential have been provided.

Geographic Coverage--The collection is global in origin and almost equally divided between the New World and Old World (49.3% and 50.4% respectively). The breakdown of collection holdings by major geographic area is: North America (32.9% of catalog entries), Indo-Australia (20.9%), Asia (15.4%), South America (10.4%), Africa (9.0%), Central America (4.7%), Australia (2.7%), Caribbean (1.2%), Pacific (0.9%), Europe (0.6%), Madagascar (0.5%), Atlantic Ocean (0.3%), and Indian Ocean (0.1%).

Some of the strongest foreign holdings (major collectors/donors in parentheses) are from Australia (David Liem, William Hosmer); Malaysia (Robert F. Inger, Harold K. Voris, Edward O. Moll); Philippine Islands (Dioscoro S. Rabor, Harold Hoogstraal); Thailand (Edward H. Taylor, W. Ronald Heyer, Robert F. Inger); Taiwan (Robert F. Kuntz); China (Cheng-chao Liu, Clifford H. Pope, Robert F. Inger); Egypt (Harold Hoogstraal); Colombia (Federico M. Medem, Kjell von Sneidern); Chile (Tomás Cekalovic K., Luis E. Peña); Peru (John E. Cadle, Karl P. Schmidt, Luis E. Peña, Felix Woytkowski); Mexico (Edward H. Taylor, Hobart M. Smith, Clifford H. Pope, Ernest G. Marsh, Howard B. Shaffer, James Hanken); and Central America (Karl P. Schmidt, Harold Trapido, Edward H. Taylor, Emmett R. Dunn). The Division's Malaysian collections undoubtedly constitute the largest accumulation of preserved Malaysian herpetofauna in the world. Additional areas of strength include Brazil, Sri Lanka, India, South Africa, Tanzania, Zaire, and southwestern Asia. The total number of catalog entries from the United States is approximately 49,500. States representing from five to ten percent of this total include (ranked highest to lowest): Illinois, New York, Texas, North Carolina, Mississippi and Indiana. Significant collections of United States material were made by or received from the following individuals (states given in parentheses): Sherman C. Bishop (New York); Denzel Ferguson (Mississippi); Edmund Heller and Sherman C. Bishop (California); and Walter Stille (Illinois and Indiana).

Systematic Coverage--The collection contains 6,229 species, 1,136 genera, 88 families and 9 orders and suborders. These constitute 86% of the genera, 99% of the families, and 100% of the orders and suborders recorded by Myers (1988). The taxonomic breadth of the collection is revealed by comparing the number of species in the collection to the total number of extant species as recognized by Halliday and Adler (1986) for amphisbaenians, lizards, and snakes; Iverson (1992) for turtles; King and Burke (1989) and Ross (1990) for crocodilians; Daugherty et al. (1990) for rhynchocephalians; and Duellman (1993) for amphibians. The Field Museum's herpetological collections contain approximately 56% of the 11,084 extant species of reptiles and amphibians. The breakdown of collection holdings by order or suborder is: frogs (42.6% of catalog entries), salamanders (12.4%), caecilians (0.25%), turtles (1.97%), rhynchocephalians (0.006%), lizards (26.4%), snakes (16.0%), amphisbaenians (0.16%), and crocodilians (0.26%).

Frogs--The frog collection contains representatives of all families, 80% of all genera, and approximately 51% of all species. Much of the diversity and quantity of the frog collection is due to the field work of Robert Inger in Malaysia, Thailand, China, India, and Zaire. Particularly significant also are the collections made in western China by Cheng-chao Liu and studied by him while resident in the Division during 1946 and 1947 and the New Guinean and Australian specimens received from David Liem.

Salamanders--The salamander collection contains representatives of all families, 84% of all genera, and approximately 77% of all species. The salamander collection contains specimens assembled by some of the most important collectors and researchers including Sherman C. Bishop, Clifford H. Pope, Karl P. Schmidt, Richard J. Newcomer, Robert E. Gordon, H. Bradley Shaffer, Cheng-chao Liu, and Edward H. Taylor.

Caecilians--The caecilian collection contains representatives of all families, 73% of all genera, and approximately 41% of all species. The caecilians (including type specimens) that formed the basis for Edward H. Taylor's classic 1968 monograph were acquired through the purchase of his collection.

Turtles--The turtle collection contains representatives of all families, 83% of all genera, and approximately 80% of all species. The Edward O. Moll collection from Malaysia is a relatively new addition that contains species that were previously not or only poorly represented in our collection. The turtle holdings from areas of geographic strength such as Malaysia, Thailand, and Mexico are well represented, taxonomically and numerically.

Rhynchocephalians--Two species comprise the recent sphenodontidans. The collection contains only one of these species. The holdings number fifteen specimens. Several of these are skeletonized or cleared and stained.

Lizards--The lizard collection contains representatives of all families, 87% of all genera, and approximately 54% of all species. The lizard collection contains eight specimens of the extremely rare, earless monitor (*Lanthanotus borneensis*), the sole species in the subfamily Lanthanotinae. The specimens of *Lanthanotus* are constantly in demand by researchers worldwide and are usually on loan. Particularly valuable, for example, to researchers are the large series of Bornean lizards. Our holdings of the agamid genus *Draco* (flying dragons) dwarf the combined holdings of other museums. Such large series support studies that would be impossible otherwise. Additionally, such large series also allow several researchers to work on subsets of the material simultaneously, thereby alleviating the need to shift the same material from one researcher to another. Significant also are holdings of the family Xenosauridae which contains only two rare genera, *Shinisaurus* and *Xenosaurus,* and two adult, whole body, fluid preserved Komodo dragons (*Varanus komodoensis*).

Snakes--The snake collection contains representatives of all families except the Bolyeriidae, 87% of all genera, and approximately 65% of all species. One of the single, most important subsets of the collection are the sea snakes (Hydrophiidae) collected by Harold Voris. Significant also are several specimens of the virtually unobtainable viperid, *Azemiops*. The snake skull collection is extremely varied taxonomically and contains large series of single species of aquatic snakes.

Amphisbaenians--The amphisbaenian collection contains representatives of all families, 81% of all genera, and approximately 33% of all species.

Crocodilians--The crocodilian collection contains representatives of all families, 100% of all genera, and approximately 96% of all species. Several species are present in large series. The crocodilian holdings (particularly skulls) were enhanced by the purchase of Federico Medem's collection (1955-1966).

Type Collection--The type collection contains 1,284 named forms (species and subspecies) of which 485 are represented by holotypes. The lists of type specimens have been published (Marx 1958, 1976). Frogs, lizards, snakes, and salamanders comprise 36%, 29%, 21%, and 10% of the named types, respectively.

Skeletal Collection--The skeletal collection contains over 5,000 dry skeletons and over 300 cleared and stained specimens. The snake skull collection is particularly taxonomically representative due in large part to the research efforts of Curator Emeritus Hymen Marx. The sea snake (Hydrophiidae) skull collection is particularly valuable not only because of its taxonomic representation but also because of the large series of each sex of selected species. The hydrophiid skulls were prepared through the efforts of a dedicated, long term volunteer, Sophie Anne Brunner. Cleared and stained turtle, lizard, and crocodilian embryos, prepared and published on by Geology Curator, Olivier Rieppel, form a valuable subset of the collection.

Auxiliary Collections--The Division maintains the following auxiliary collections: histological slides (6,640); stomach contents (>3000); frozen tissues (729); tape recordings (33); color slides (>1,900); black and white photographs (>1,230); X-ray negatives (175); field notes (619 sets), maps (>200) and original illustrations (>150).

Karl P. Schmidt Memorial Herpetological Library--This branch of the main Field Museum Library contains approximately 1,792 books and 36,000 reprints on herpetology. Donations of extensive herpetological libraries (Karl P. Schmidt, D. Dwight Davis, Emmett R. Dunn, Robert F. Inger, and Walter L. Necker) as well as an active reprint exchange program have enhanced the breadth of the library.

Archives--The archives, housed in the main library, include the Karl P. Schmidt and Emmett R. Dunn correspondence.

Division of Birds: Collections

The bird collection of The Field Museum houses one of the largest and most comprehensive scientific collections of birds in the world. The collection began as a byproduct of the Field Columbian Exposition in 1893, when Ornithology was one of six scientific departments of the new museum. The first large core collection came with the hiring of C. B. Cory in 1906. The next fifty years were a period of major acquisition of large collections from around the world. In 1920, the collection contained about 50,000 specimens, by 1940 it had grown to 137,000, and in 1960 it held 262,000 specimens. Following accession and cataloging of a major acquisition in 1980, the collection numbered about 310,000 specimens. As a result of a vigorous collecting program, the collections have grown substantially over the past fifteen years. Today there are more than 400,000 specimens in the Bird Division's skin and anatomical collections.

Today, the Division of Birds houses the third largest scientific bird collection in the United States. The main collection contains over 410,000 specimens, including 600 holotypes, 30,000 skeletons, and 6,000 fluid specimens. In addition, the division houses 16,500 egg sets and 200 nests. The scope of the collection is worldwide: all bird families but one are represented, as are 85% of the world's species. Included among its many historically and scientifically valuable individual collections are the H. B. Conover Game Bird Collection, Good's and Van Someren's African collections, C. B. Cory's West Indian collection, the Bishop Collection of North American birds, a large portion of W. Koelz's material from India and the Middle East, and many separate collections from South America, Africa, and the Philippines.

As priorities and staffing of educational institutions shift, teaching and research collections can often become orphaned. The Division of Birds has demonstrated a willingness to work with these institutions to ensure that their collections receive proper care. However, when administrators are unwilling or unable to maintain collections at their institutions, it is important that museums offer to house and curate them. In recognition of this responsibility, The Field Museum has accepted three such collections in recent years (from Northern Illinois University, Princeton University and the University of Miami).

Geographic Strengths--The collection is strongest in North American (including all species and virtually all subspecies), Neotropical and African material (about 95% of species in both areas), the Philippines, and India. Significant additional holdings exist from all regions of the world except Micronesia. Even in areas of relative weakness, however, large-scale exchange programs with other museums have resulted in at least synoptic representation.

Skin Collection--The Bird Division's skin collection ranks third in absolute size among the North American collections, and is fourth largest in the world. In systematic and geographic breadth, the ranking is roughly the same. In addition, certain of its holdings are as extensive and complete as any in the world (e.g., Conover game Bird Collection, Van Someren and Good central African collections).

Eggs--The egg collection, which includes a portion of the massive and renowned R. M. Barnes collection, ranks sixth in size in North America (with 16,500 sets).

Skeletal and Fluid Preserved Material--The Field Museum holdings in skeletal and fluid-preserved specimens rank seventh and tenth in size in the world, respectively. Because of their growing importance in avian systematic studies, the anatomical collections have been the focus of special efforts by the Bird Division staff over the last five years. In the three years between the first two editions of the "Avian Skeletal Specimen Inventory," The Field Museum has jumped from thirteenth to seventh in overall size and from twelfth to seventh in overall breadth. This effort to expand the anatomical holdings is expected to continue in the next several decades.

Frozen Tissues--In recognition of the increasing importance of biochemical approaches in evolutionary biology, a collection of frozen tissues has been established within the Bird Division.

Salvage Program--In addition, the Bird Division operates a salvage program that adds between 1,000 and 2,000 specimens per year to its collection, chiefly anatomical specimens of local and migratory North American Birds.

Division of Fishes: Collections

Established in 1894, The Field Museum's fish collection now contains nearly 1.7 million specimens in 125,000 lots. The scope of the collection is worldwide. Some 300 nominal families and more than 7,000 nominal species are represented, including three well-preserved specimens of the Coelacanth.

The Division of Fishes serves the research needs of scientists and students on all continents, both through their visits to the division and through outgoing loans. Continued scientific interest in the holdings of the fish collection stems not only from its historically important specimens and types, but also from the active incorporation of new material into the collection. Much of the growth of the collection was derived from the active field and collection programs of the curatorial staff. S. E. Meek (1897-1914) pioneered the study of the freshwater fishes of Mexico and Central America. L. P. Woods (1941-1978) amassed large and important collections of freshwater and marine fishes from North America, and the Atlantic, Indian, and Pacific Oceans. R. K. Johnson (1972-1986) obtained significant collections of open-ocean mesopelagic fishes, and shorefishes from Belize and Honduras amounting to 100,000 specimens. D. J. Stewart (1978-1985) made outstanding collections of freshwater fishes from Ecuador, Peru, and Venezuela.

The ichthyological collection at The Field Museum is an internationally recognized systematic resource, and is ranked among the largest, most diverse, and most important fish collections in the world. Its importance has been recognized by the Advisory Committee for the Development of a National Plan for Ichthyology of the American Society of Ichthyologists (Collette and Lachner, 1976). This committee and recent surveys (ASC Survey, 1988; MITRE report 1993) have ranked The Field Museum within the top ten most important international ichthyological resource centers in North America. The ranking is based not only upon the size of the holdings but also the geographic coverage of the collection and the extensive type collection.

The specimens comprise approximately 125,000 lots of which 104,000 catalog numbers are assigned. (The number of database entries has been reduced to 83,231 by consolidating single lots that were given multiple catalog numbers). The large backlog of uncatalogued fishes is largely a function of the extensive collecting efforts of previous curators (e.g., R. K. Johnson in Central America, D. J. Stewart in South America, L. Woods in the Indian Ocean), acquisition of the Northern Illinois University Collection, and the Chicago Sanitary District fish survey. Much of the backlog is identified to family, sorted to genus, and requires further identifications.

Systematic Coverage--More than 9,000 species in 320 families are estimated to be represented in the collection (including the backlog of uncatalogued fishes). Using the estimates provided by Nelson (1984), the ichthyology collection of The Field Museum has representatives of 41% of the estimated living species of fishes and 72% of the families. This systematic breadth engenders ecological and environmental diversities within the collection from the full range of freshwater habitats, to estuarine, to shallow-marine nearshore, to offshore and to deep sea environments.

Geographic Coverage--The collection contains specimens from all continents, many countries (ca. 48%), all oceans, most major seas, and many islands or island groups. The collections are divided almost equally between freshwater and marine holdings. Collections of premier importance include those from: the freshwater of Mexico, Central and South America; the western tropical Atlantic, especially from the Gulf of Mexico and western Caribbean; and fresh and nearshore marine waters of North America. There are also important, diverse holdings of fishes from East Asia, Southeast Asia, and the Indian and Pacific Ocean basins. Field Museum ichthyological resources from other regions (e.g., Iraq, Poland, Lebanon, China) are generally not well represented in other United States institutions.

Type Specimens--The collection is especially rich in type specimens. Holdings of type materials (850 primary types, 750 secondary types) place The Field Museum among the five most important type depositories in North America. There are at least 1,410 nominal species represented by primary types. At present, estimates are not available for the total number of primary and secondary types, because the type catalogs of Gray (1947) and Ibarra and Stewart (1987) do not provide counts of the secondary types. The type holdings comprise taxa from five continents and the

Atlantic, Pacific and Indian Oceans. The type collection derives from the following sources: exploratory fieldwork and systematic research of curators and associates, purchase of the Carnegie Museum fish collection in 1952; and receipt of gifts or exchanges from colleagues throughout the world. Acquisition of the Carnegie Museum collection, with about 500 taxa represented from primary types (Henn, 1928) more than doubled the type collection of fishes in The Field Museum (Ibarra and Stewart, 1987). Most of the taxa represented by Field Museum types were described after 1900, with the largest percentage described between 1905 and 1930 (see Ibarra and Stewart, 1987, Fig. 1). The majority from that time were described by S. E. Meek (Field Museum), S. F. Hildebrand (United States National Museum), C. H. Eigenmann (Indiana University), D. S. Jordan (Stanford University), C. L. Hubbs (Field Museum, University of Michigan), C. H. Gilbert (Stanford University), J. D. Haseman (Carnegie Museum) and their associates.

Historically Significant Materials--In addition to the type collection, The Field Museum maintains much other material of historic value. These collections include pre-1930 materials from areas that have or are now undergoing significant environmental changes (e.g., United States, Mexico, North Borneo, Mexico, Central and South America, etc.). Much of this material is documented in the now classic works of Meek, Meek and Hildebrand, and Eigenmann and his students, among others. Other material of historic importance includes the turn of the century collections from the United States and Mexico by A. J. Woolman, and collections from Japan, Taiwan, Korea and China by Jordan and colleagues, as well as the numerous purchases by A. Owston.

Skeletal Material--The skeletal collection comprises more than 3,600 skeletons from more than 210 families of fishes. Of these, approximately 1,200 are dry, articulated or disarticulated preparations from 147 families, and the remainder are cleared and stained specimens. Dry skeleton preparations are facilitated by the dermestid colonies maintained by the Museum.

Special Collections--There are a number of special collections (e.g. freshwater fishes from Borneo, Iran, Lebanon) that are unique or unusual among United States holdings. The collections also contain extensive holdings of large fishes. The collection has 135 specimen tanks that hold 1,163 large specimens from 114 families. However, two collection areas, neotropical freshwater and marine fishes, warrant special mention because our holdings are especially important and have been growing in size and value.

Marine Fishes of the Western Caribbean and Indo-Pacific--Two major marine collections are those of A. Owston in the Japanese Archipelago during the early 1900s and L. P. Woods in the Pacific and Indian Oceans in the 1960s. The Owston collection contains over 1,100 lots, and the Woods collections represent over 1,200 catalogued lots and an additional estimated 800 lots of backlog material. More recently, R. K. Johnson and D. W. Greenfield have been collaborating on an intensive faunistic, systematic, ecologic, and zoogeographic study of western Caribbean shorefishes. They have specialized in Belize and Honduras, bringing to The Field Museum more than 100,000 specimens comprising ca. 10,000 lots during the decade 1970-1980. In the last four years M. Westneat has added approximately 200 lots (>2,000 specimens) of fishes from the Eastern coast of the United States, approximately 800 lots (>10,000 specimens) of fishes from the Northern Great Barrier Reef of Australia, and approximately 200 skeletal specimens, 200 lots from Thailand, 200 lots from Philippines.

Neotropical Freshwater Fishes--Beginning with the work of S. E. Meek in Mexico and Central America, the ichthyological collection has maintained important and still growing collections of neotropical freshwater fishes. In the last fifteen years, D. W. Greenfield, J. Thomerson and their collaborators have placed in The Field Museum more than 50,000 specimens comprising ca. 2,000 lots and 107 species from 150 different localities within Belize. The Carnegie Museum collection, accessioned in 1951, included the substantial collections made by C. H. Eigenmann and his associates in South America earlier this century. D. J. Stewart (Assistant Curator of Fishes, 1978-1985) brought in abundant material from collecting trips to Venezuela (1979), Peru (1980), and Ecuador (1981, 1983). His collections in the Rio Napo basin of Ecuador have brought to The Field Museum approximately 83,200 specimens (not including the 41,600 specimens returned to Ecuador) in approximately 4,250 lots representing more than 430 species. The Napo collection containing samples from more than 200 different localities between 200m and 2500m elevations is among the finest collections ever made for a neotropical river basin of its size. B. Chernoff has continued to increase the neotropical freshwater collection. In the past five years, Chernoff's collections from Peru and Venezuela contain approximately 50,000 specimens in over 1,900 lots, with more than 100 species new to the collection.

Division of Insects: Collections

Arthropods--The Field Museum's Division of Insects houses worldwide collections of Arthropoda (excluding Crustacea) that rank fifth in overall size among North American collections. At present, the collection includes approximately 3.9 million pinned insects and 6.4 million specimens or lots of insects and other arthropods in alcohol or on slides. More than 200,000 named species and subspecies are represented, over 10,000 of them by types including at least 9,200 primary types. To a greater degree than most other large collections, however, the growth of these collections has been strongly focused taxonomically, ecologically and geographically. As a result, some elements of the collection (e.g., world Staphylinidae, soil arthropods, and some groups of mites) are of unique importance and see heavy international use, while others are of lesser or only local significance.

Beetles--Coleoptera is by far the best represented and most heavily used major insect order in The Field Museum collections, with unusually comprehensive material at the family and generic level. The collection of Palearctic (Eurasian and North African) beetles is the most extensive in this hemisphere, as are collections from Australia, the Philippines and Micronesia for at least many beetle families. The countries of Central and South America are also exceptionally well represented, including perhaps the largest collection of Chilean beetles (including the L. Peña collection) in existence. North American collections are significant, especially for the northeastern United States, where the recent addition of the N. M. Downie collection provides nearly complete species representation for this area, including voucher specimens for a new guide to beetle species of northeastern North America (Downie and Arnett 1994, two more volumes in progress).

Staphylinid Beetles--Outstanding among Coleoptera is the collection of Staphylinidae (the second-largest beetle family with over 42,000 named species), certainly the largest collection in the world and probably the most comprehensive and rich in species represented by types (rivaled only by the British Museum). This family alone accounts for nearly a third of all loan use of the insect collection , and includes nearly half of the species in the entire collection represented by types. Several other beetle families (e.g., Histeridae, Ptiliidae, Leiodidae, Cleridae, Mordellidae, Lucanidae) are unmatched among New World collections in world representation of genera and species (probably surpassed only by the British and Paris Museums), and others have tremendous strengths in particular regions (e.g., Elateridae, Buprestidae, and Cerambycidae for North America, Tenebrionidae for South America as well as world genera) or subtaxa (Scarabaeidae: Cetoniinae).

Butterflies and Moths--The Lepidoptera collection stands out as by far the strongest of the other large orders, with good worldwide holdings of macrolepidoptera, both butterflies and moths. The single largest element is the Strecker Collection, a world-wide collection of nearly 50,000 specimens built up in the late 19th century and including over 450 types of species or subspecies described by Strecker or others. At the time of his death in 1901, Strecker's collection was the largest and most important private collection of butterflies and moths in the New World. Recent curatorial work in the Strecker Collection turned up previously unrecognized type material. Other strengths are North American Lepidoptera (about 75% of named species of Macrolepidoptera) and European moths.

Vertebrate Ectoparasites--Another major element of The Field Museum collection is ectoparasites of vertebrates. Most significant among those are the ectoparasitic bat fly families Streblidae and Nycteribiidae: our holdings are unparalleled in the world and include over 75% of the known world species, including types of 40% of known species. We also have 50% of described tick species of the world; about 30% each of described flea and sucking louse species (and types of over 250 species of fleas); and major holdings of parasitic mites from Australian and Neotropical hosts. Most of these specimens were collected by mammalogists and have excellent host data, making them a superb resource for host-relationship and coevolutionary as well as purely systematic or taxonomic studies.

Bulk Arthropod Samples--The Field Museum is one of the world's largest repositories of bulk arthropod samples of various kinds, collected by museum staff and associates and by collaborators from numerous other institutions. The majority of these are samples of soil and litter faunas (mostly from forests) around the world, extracted by use of Berlese funnels or other means including deep-soil washing, and stored in 70% alcohol. Most samples have full ecological data. At over 14,000 samples, this is undoubtedly the largest such collection in existence. Most samples have had some taxa removed (e.g., beetles or mites), but still contain vast numbers of other arthropods. In addition to the soil and litter samples, there are also samples from some 4,000 trap collections (flight intercept, pitfall, dung- and carrion-baited pitfall, and blacklight) and small-scale pyrethrin-fogging. The spiders extracted from some of these samples provide an excellent example of the significance of this resource: they include representatives of some 70% of all spider families, including many that are generally rare in other collections. Similarly, the representation of Coleoptera from the bulk samples is extremely comprehensive at the family level--about 80% of described families and nearly two million specimens in alcohol.

Arachnids--In addition to the vertebrate parasites mentioned, the collection contains major holdings in several additional mite groups, especially: Hydrachnidia (water mites; types of 90% of described North American species and numerous types from other areas), Neotropical Opilioacariformes, Australian and Neotropical Holothyrida, World Trigynaspida, New World Endeostigmata, World Trombiculidae (chiggers; including over 1,500 type slides), and arthropod-associated mites (especially World Eviphidoidea). The spider collection of nearly 100,000 lots is also of growing importance, with recent additions from Madagascar.

Division of Invertebrates: Collections

Established in 1938, the Division of Invertebrates, which began with a collection of 16,000 lots, now manages over 317,000 lots, with approximately 5 million specimens. Most of these belong to the phylum Mollusca, and our molluscan collection now ranks among the top three or four in North America. The various components of our collection, described below, are valuable in establishing historical records of species distributions important to conservation, studies of biogeography, biodiversity and ecology as well as providing information necessary in studies of evolution, functional morphology, and systematics.

Systematic Coverage--A 1993 survey found specimens of 62% of the currently recognized mollucan families present in the collection with 80% of the shelled molluscan families represented in that percentage. Approximately 68% of our holdings are terrestrial taxa, 18% marine and 14% freshwater.

Geographic Coverage--Within the terrestrial and freshwater molluscan collections there is strong representation from the Neotropical, Nearctic, Pacific Island, Australian and European regions. The marine mollusk collection has a world-wide coverage with strengths in Florida and the Caribbean.

Terrestrial Mollusks--Holdings of recent pulmonate gastropods (land snails) contain approximately 3.5 million specimens in about 210,000 lots and represent roughly 35,000 species. This collection is one of the most comprehensive in the world and an internationally recognized resource, with geographic concentrations in North America, Australia and the Pacific Islands, Central and South America, and Europe. It contains a great variety of alcohol-preserved specimens and one of the most diverse holdings of modern field collections of land snails. Acquisition of the Leslie Hubricht Collection in 1990 made this the premier collection of North American terrestrial mollusks. Through NSF support the Hubricht Collection has been completely rehoused and relabeled in archival quality storage materials. In addition, the Beetle-Pillmore Collection of U.S. land snails (ca. 4,800 lots) has also been rehoused into archival quality storage materials. The large holdings of eastern U.S. species comprise a unique resource for ecological, environmental, systematic and other studies. Dr. Alan Solem (curator 1957-1990) was largely responsible for amassing this important collection.

Freshwater Mollusks--The freshwater mollusks are estimated to number 30,000 lots of gastropods (snails) and 14,000 lots of bivalves (clams). The freshwater snails of eastern North America are well represented in the collection, providing an excellent resource for systematic and ecological studies. Other geographic areas covered by these collections are Southeast Asia and the Philippines, South America and Europe. The bulk of the freshwater bivalves are composed of an outstanding unionid collection assembled by Dr. Fritz Haas (curator 1938-1958) and recurated in 1993 by visiting scholar, Dr. Arthur Bogan. He found some 72% of the genera in the superfamily Unionoidea represented in our collection. The majority of endangered species in the U.S. are unionids and species of this group are often sensitive environmental indicators. The area of geographic strength in our freshwater bivalves is North America.

Marine Mollusks--Most marine material, approximately 55,500 lots, was received as part of formed collections or as voucher material. There is a good synoptic representation of the extant marine mollusks and a growing, taxonomically diverse collection of small-shelled "micro" mollusks. Geographic coverage is world-wide with strengths in Florida and the Caribbean. The collection contains considerable historically important marine material acquired in several major private collections, for example those of Charles D. Nelson, Fred Button and Walter Biese. Recent growth in the marine collections has resulted from the work of the present curatorial staff. The research-related field work of Dr. Rüdiger Bieler focuses on three areas: (i) building a truly synoptic collection of gastropods to assist in group-wide phylogenetic analyses based on anatomical and molecular data, (ii) building a collection of "worm-snails" to study their biology and phylogeny, and (iii) further strengthening our focus on tropical/subtropical Western Atlantic holdings for zoogeographic studies. The cephalopods, prior to the arrival of Dr. Janet Voight, were comparatively under-represented in the collection. Since 1990, specimen acquisition through orphan collections, cooperation with fisheries surveys and collaborative research by Voight has increased the cephalopod collection to include most of the recognized families and many octopus genera. Strengths of this collection are to be found in squids from the North Pacific and Gulf of Mexico to the North Atlantic and octopuses from hydrothermal vents on the floor of the Pacific Ocean.

Type Specimens--The molluscan type collection contains representatives of several thousand nominal taxa. Type designations by just three Field Museum-associated authors, Haas, Hubricht and Solem, account for over 500 species. Additional type material of species described as early as 1860 entered the collection through the accessions of various formed collections. These collections added to the breadth of our holdings and contained voucher material from published research, although comprehensive counts are unavailable. These historic collections are especially important because they document changes in geographic ranges and often contain species now extinct.

Non-Mollusk Invertebrates--The Division of Invertebrates currently holds approximately 8,000 lots of non-mollusk invertebrates, 3600 of which are identified and catalogued. Crustaceans comprise over half of this material. Although the core of these holdings are collections acquired by The Field Museum from the 1893 Columbian Exposition, type specimens (mostly paratypes) constitute 88 lots, representing 49 nominal species in five phyla. Additions to these collections have come via collecting efforts with primary focus on other groups and the deposit of voucher material.

Auxiliary Collections--The Division of Invertebrates houses several auxiliary collections: radulae on SEM stubs; a reprint collection of invertebrate scientific literature; and over 6,500 Scanning Electron Microscope photos and negatives of molluscan feeding apparatus and shell microstructures which are a unique resource for systematic studies. Recently, frozen specimens and other material especially preserved for DNA and fine-anatomical research were added to our auxiliary collections.

Fluid-Preserved Specimens--Numerous field programs have resulted in one of the most diverse holdings of alcohol-preserved land snails, a resource that has been important in several recent family and higher level taxonomic revisions. Fluid-preserved marine specimens, including "micro" mollusks, form a rapidly growing segment of the collection.

Division of Mammals: Collections

Established in 1894, the collection of the Division of Mammals is worldwide in scope, and with 155,671 specimens is one of the largest, most representative and most heavily used collections of mammals in the world. In terms of absolute numbers of specimens, it ranks third or fourth in the nation, and in terms of geographic and taxonomic representation, it probably ranks third in the nation and fourth in the world. More than 410 primary type specimens are included in the collection.

Over the last twenty years, major transformations have brought the mammal collection to high standards of curation. Beginning in 1975, nearly the entire collection was moved into newly-constructed quarters; nearly all of the dry collection was accommodated in new specimen cases, and sufficient space has been allocated for several decades of growth. Staff eliminated a large backlog of skeletal specimens; input, edited and verified nearly all collection data in computerized files; constructed a new, well-equipped tanned skin facility; and adopted a large "orphaned" collection of large African mammals originally collected in the 1920s. Field Museum staff have also cataloged and installed large backlogs; updated geographic information on specimens; completed verification of the dry collection; and re-identified large parts of the dry collections (with assistance from Visiting Curators).

Recent collection growth has included specimens from recent field work in East Africa (especially Madagascar, Burundi, Tanzania and Uganda), South America (especially Brazil and Chile), and Southeast Asia (especially Malaysia and the Philippines), and from a wide range of other parts of the world. Growth of the fluid-preserved collection has been especially rapid. Nearly all of these specimens have come from recent field work, with the majority coming from Southeast Asia and East Africa. Many of these represent the only fluid-preserved individuals of their species, and at least 20 newly-discovered species are included.

The mammal collection of The Field Museum currently consists of 155,671 cataloged specimens (as of 9 January, 1996), plus 1,500 specimens or less that await cataloging (about half of which are newly acquired through research programs). Some 15,000 specimens have been returned to our foreign collaborators after preparation and cataloging at the Museum.

Geographic Coverage--The Field Museum mammal collection is global in scope, and includes specimens from 190 countries or equivalent geographic units. The collection is especially strong in material from South America, Southeast Asia, East Africa, Southwest Asia, China, Central America, Mexico, and Australia, with smaller but very important collections from Madagascar, the Sudan, the Himalayan Front, and northern and southern Africa. In comparison with most other large collections, holdings from the United States and Canada are small (ca. 25,000). More than 40% of the specimens are Neotropical, followed by 16% Nearctic, 14% Palearctic, 13% Oriental, and 13% Ethiopian. Although the Neotropical collections represent all areas and taxonomic groups, the collections from northern Colombia and Chile are the best of their kind; Peru, Mexico, Bolivia, Brazil, Guatemala, Belize, and Ecuador are also particularly well represented. From the Palearctic Region, important collections include those from Afghanistan, Iran, Egypt, and China, while strengths from the Oriental Region include the Philippines, Borneo, Malaysia, and India-Ceylon-Nepal-Sikkim-Burma. Most of these are unique collections. Important collections from the Ethiopian Region include those from the Sudan, Tanzania, Uganda, Burundi, Kenya, Madagascar, Ethiopia, and Angola.

Systematic Coverage--The collection is equally broad in its systematic coverage. All but one family of mammals is represented (though several by only a few specimens); the Muridae (under the current broad definition) is most abundantly represented with 59,318 specimens, followed by the Phyllostomidae with 11,977, Vespertilionidae with 10,189, and Sciuridae with 9,115 specimens.

Some families that are represented by unusually large numbers in The Field Museum collection include the hedge-hogs and relatives (Erinaceidae, 803), several families of bats (Pteropodidae, 4,563; Emballonuridae, 2,030; Rhinolophidae, 4,609), flying lemurs (Cynocephalidae, 90), several families of primates (Lemuridae, 1,364; Callitrichidae, 660; Cebidae, 1,861; Cercopithecidae, 1,409; Pongidae, 152), several unusual families of rodents (Ctenomyidae, 268; Echimyidae, 1,383), large carnivores (Canidae, 2,256; Felidae, 1,365; Hyaenidae, 114), and large herbivorous mammals (Bovidae, 2,554; Cervidae, 940). These figures again indicate the global scope of the collection. Of the 136 extant families of mammals, 135 are represented, with the exception being one family of bats; approximately 83% of 1,100 extant genera are represented. Holdings of rodents and bats are especially large and complete. The Neotropical primate collection is unique owing to the endeavors of P. Hershkovitz. Most of the specimens are study skins with skulls, but some 35,000 are fluid-preserved. In addition, there are 12,000 partial or complete skeletons, including the collection of anatomist D.D. Davis, and segregated collections of genitalia, auditory ossicles, gastro-intestinal tracts and endocranial casts.

Fluid-Preserved Specimens--Although all parts of the collection are heavily used, there has been especially rapid growth and increasing use of the fluid-preserved portion during the last five years. This portion of the collection now contains over 35,000 cataloged specimens and approximately 1,480 uncataloged specimens. The fluid-preserved collection grew by 5,613 cataloged specimens (16%) in 1989-1993 (twice the rate of growth in the dry collection), the majority of which were newly acquired through current research programs. This collection includes many species that are rare in museum collections, and contains an unusually large number of large mammals.

Auxiliary Collections--The auxiliary collections in the Division of Mammals includes a fluid-preserved brain collection representing most mammalian order; 3500 preserved genitalia, several hundred auditory ossicles, and over 500 endocranial casts representing the majority of mammalian orders. There has been growth in the collection of gastro-intestinal tracts, mainly due to recent field projects of the staff. We also have several hundred owl pellets containing mammal bones, which provide important information on predation , distribution of small mammals, etc. The reprint collection in the Division continues to grow, especially with significant donations by P. Hershkovitz.

Frozen Tissues--The Division's frozen tissue collection contains over 10,000 samples, including whole tissue, DNA extracts, and cell suspensions; the collection is growing rapidly due to active field program and high level of demand for this material. The collection has recently been inventoried and is soon to be entered into a computerized database as an aid to management.

DEPARTMENT OF ZOOLOGY - COLLECTION SIZE AND GROWTH

	1994	1995	1994-1995
	Number of Specimens	Number of Specimens	% growth
Amphibians and Reptiles	265,227	265,969	0.28
Birds	411,055	419,530	2.06
Fishes	1,790,231	1,793,270	0.17
Insects	9,995,941	10,227,619	2.32
Invertebrates	3,916,500	3,923,000	0.17
Mammals	153,664	155,671	1.30
Zoology Total	**16,532,618**	**16,785,059**	**1.53**

COLLECTIONS OF THE FIELD MUSEUM LIBRARY

The formation of the Library's collections, their rapid growth in the Museum's first decades, and their continuing development are the result of the cooperative endeavors of many organizations and institutions, private donors and collectors, and the Museum's administrators, scientific staff and librarians.

Initial Collections, Special Funds, and Ongoing Acquisitions

The World's Columbian Exposition

The creation of the Library's collections commenced in 1894 with initial transfers of books from the libraries of various departments of the World's Columbian Exposition. Chief among these transfers was the collection formed for the Exposition's Department of Ethnology. This collection had been assembled by soliciting donations of books from researchers worldwide who were at that time contributing to the formation of the disciplines that were to become modern anthropological research. The 1,400 titles in this collection are well documented in the surviving manuscript list of its holdings compiled by Charles Staniland Wake (1835-1910), who served as librarian for the Department of Ethnology. Most of the titles on Wake's list are still held by the Library and form the historic core of the Anthropology Department library.

Among the geological materials assembled for the Exposition was one of several book collections formed during his career by George Frederick Kunz (1856-1932), mineralogist and gemmologist with Tiffany and Company. Judged by its titles alone, this collection might seem somewhat eclectic. In fact its 6,300 titles demonstrate the depth of scholarship Kunz brought to the task. Every work in the collection either bears directly on some aspect of mineralogy, gemmology, or metallurgy, or contains sections, chapters or even simple passages illuminating some facet of these subjects. Including one of the Library's two incunables -- a 1490 edition of Avicenna -- the collection is rich in titles from the sixteenth through the nineteenth centuries. Harlow N. Higinbotham (1838-1919), president of the World's Columbian Exposition of 1893 and president of Field Museum from 1897 to 1909, purchased the Kunz collection and presented it to the Library in 1894.

International Publication Exchange

The Museum's first publication, *An Historical and Descriptive Account of the Field Columbian Museum,* was sent to museums and scientific organizations worldwide, accompanied by solicitation for mutual exchange of publications. Several hundred exchange agreements were quickly established. As the Museum's scientific publications began to appear and were distributed to exchange partners (at that time through the Smithsonian Institution's Bureau of International Exchanges) hundreds of scientific journals began to arrive in the Library. In time the number of exchange partners exceeded 1,000 and has been maintained at that level to the present. Each of these partners receives one or more of the Museum's four series of *Fieldiana* covering the areas of anthropology, botany, geology and zoology. Each exchange involves an approximate parity in the value or number of titles supplied. At its beginning the exchange program brought the Library several hundred journals; by the time it reached its full development, it provided nearly 2,000 scientific serials. The result of the exchange program is the Library's rich and extensive holdings of core journals in the Museum's research disciplines, a collection of rarely held materials that could not now be duplicated.

Edward E. Ayer

Edward Ayer (1841-1927) has been the principal benefactor of Field Museum Library. Instrumental in the founding of the Museum, and serving as its first President, Ayer gave great attention to the Library from the moment it was organized. In 1894 he presented to the Library his private ornithology collection of over 400 carefully chosen volumes, and purchased the 600 volume collection of ornithologist Charles Barney Cory (1857-1921). In the same year he donated the ichthyology and angling collection of over 1,000 volumes formed by Robert Clarke, and presented the Library as well with his own collection on ichthyology. All these collections are distinguished by their rich retrospective coverage of these fields, which is an essential resource for ongoing biological systematics. These collections are also marked by the beauty of their scientific illustrations, the majority of which are hand-colored engravings and, from the mid-nineteenth century on, hand-colored or color-printed lithographs. Ayer continued to develop these collections through his own acquisitions and through an endowed fund for book acquisitions by the Library in these areas. The continuous development of the Ayer Ornithology Library during Ayer's lifetime was driven by his desire that it should be among the foremost collections of its kind. His success in achieving this goal became evident in the year before his death when the Museum published John Todd Zimmer's *Catalogue of the Edward E. Ayer Ornithological Library* (Chicago, 1926). This classic of ornithological bibliography clearly confirmed the Ayer Collection as one of the finest in the world. After Ayer's death, his endowments for the library were combined into a single fund, referred to simply as the Library Fund, whose earnings have provided the core support for book acquisitions for the ensuing seven decades.

Other Endowed Acquisition Funds

In the 1970's, under the auspices of Field Museum president E. Leland Webber, several new endowments were established to provide book acquisition funds for the Library. Along with the Library Fund, derived from the early donations of Edward Ayer, these three additional funds provide critical support for ongoing book acquisitions to the Library collections. The many thousands of titles acquired through these funds support all aspects of the Museum's mission by providing an essential research resource. The funds established during this time were: The Cherry Library Fund in Memory of Samuel M. Cherry, The Louis A. and Frances B. Wagner Library Fund, and The Jane B. Tripp Library Fund.

Mary W. Runnels Rare Book Room

In the late 1970's a major fund was established to create the Mary W. Runnells Rare Book Room and to support acquisitions to the collections it was to hold. Construction of the room was completed in 1981 and this splendid facility housing the Library's rich special collections was officially opened on December 2 of that year. The room is named as a memorial for Mrs. Runnells, donor in 1969 of the Library's exceptional copy of the double elephant folio first edition of John James Audubon's *The Birds of America* (London, 1827-1838). The Runnells Rare Book Fund has made many significant additions to the collections. Several lacunae in the Ayer Ornithology Collection have been filled with purchase of rare works by Thomas Brown, Polydore Roux and Du Bus du Gisignies. Other acquisitions have included the eighteenth-century travel narratives by Bartram and Colnett; original illustrations by British ornithologist John Prideaux Selby; the mycological library of Rolf Singer; the joint acquisition with the Friends of Field Museum Library of a set of the works of the sixteenth-century naturalist Ulisse Aldrovandi; and the purchase in 1985 of one of the Library's principal desiderata at that time, a first edition, first issue of Charles Darwin's *On the Origin of Species,* published in 1859.

The Friends of Field Museum Library

Formed in 1989, the Friends of the Library joined the Runnells Fund in supporting the ongoing development of the collections held in the Mary W. Runnells Rare Book Room. In the few years since its formation the Friends group has made impressive contributions to the Library's collections. Acquisitions have included: Roderick I. Murchison's *The Silurian System,* (London, 1839), a classic work on stratigraphy and paleontology; the official narrative of the Beagle voyages, published in 1839, which includes Charles Darwin's *Journal of Observations on Geology and Natural History,* his first published book; the joint acquisition with the Runnells Fund of a set of the works of Ulisse Aldrovandi (1527-1605); Robert Kaye Greville's *Scottish Cryptogamic Flora* (1823-1828); Richard Bradley's *Philosophical Account of the Works of Nature* (1723); the modern facsimile (1986) of *Birds of the Pacific Slope,* the previously unpublished ornithological accounts and illustrations by Andrew Jackson Grayson (1818-1869), self-styled successor to John James Audubon; and Jean Bauhin's *Historia Plantarum Universalis* (1650-1651), an important work in pre-Linnean botanical systematics.

Collectors and Collections, Private and Curatorial

Development of the Library collections has benefited from the presence and generosity of sophisticated bibliographers and dedicated collectors among the Museum's research and other staff. Curatorial staff have regularly donated important works to the Library and have often directed their personal collections to the Library by bequest. The Museum's librarians have also seized every opportunity to acquire significant private collections by donation or purchase.

Berthold Laufer (1874-1934), curator of Asian Anthropology from 1908 to 1934, was a pioneer in the study of Asian cultures. Polymath and polyglot, his interests seemed unbounded and his linguistic skills unequaled. His extensive book collections came to the Library by bequest and enriched many areas of the Library's holdings. His collection of over 7,000 volumes in Chinese includes imprints from the fifteenth to the twentieth centuries, and includes such rarities as a copy of the official Ming Dynasty gazetteer published in 1461. Laufer's extensive working collections in Western languages include thousands of scarce imprints and ephemeral publications, and are especially rich in east European materials.

George Amos Dorsey (1868-1931), curator of anthropology from 1898 to 1915, was a formative influence in the study of the native cultures of the American Southwest. The Library received considerable materials through his active collecting in that field.

Charles Frederick Millspaugh (1854-1923) was the first Curator and Chairman of the Museum's Botany Department, a position he held up to the time of his death. Millspaugh was a great builder of the Museum's herbarium and of the Library's collections in botany. His book collection came to the Library by bequest, strengthening many subject areas, especially in economic and medical botany. Included in his library were many presentation and other association copies of important works. Also included were important materials relating to publication of Millspaugh's classic *American Medicinal Plants* (New York and Philadelphia, 1884-1887). Among these materials are a volume containing Millspaugh's original watercolor illustrations for the book, each accompanied by a proof print; Millspaugh's own copy of the work as originally issued; and over a hundred proof sheets of various portions of the text with extensive corrections in Millspaugh's hand.

Several notable zoologists enriched the Library's holdings in their special disciplines by contributions during their lives and by bequest of their collections. Karl Patterson Schmidt (1890-1957), Curator of Herpetology from 1922 and Curator of Zoology from 1941, was a thorough bibliographer and collector. At the time of his death his book and reprint collections were virtually exhaustive. Schmidt's manuscripts and papers, held among the Library's Special Collections, contain considerable material documenting his pursuit of book collecting. Wilfred Hudson Osgood (1875-1947), Curator of Zoology from 1909 to 1941, made similar contributions to the Library's holdings in mammalogy and ornithology. His personal collection contained many presentation copies of important works and included numerous editions of the works of Linnaeus and other eighteenth-century authors. The bequest of the library of Henry Boardman Conover (1892-1950) built further on the strengths of the Edward Ayer Ornithology Collection. Conover, who became a Trustee of the Museum in 1941, had been a Research Associate in ornithology since 1924. His collection was especially strong in modern imprints, but also filled several gaps in the earlier literature of ornithology.

In the 1930's Museum President Stanley Field presented the Library with his choice collection of books documenting the history of the British presence in North America. This collection contains first editions of the published narratives of British voyages of discovery, from Anson to Cook, Vancouver, Franklin and Hearne. Exploration of the interior of the continent is represented by Jonathan Carver and Lewis and Clark, and by the important ethnographic works of Schoolcraft, M'Kenney and Hall, and Edward S. Curtis. This is a distinctive personal collection, notable also for its many fine bindings, both in original states and in careful restorations.

LIBRARY ACQUISITIONS AND COLLECTION USE, SUMMARY TABLE, 1995

Library	Holdings 12/31/94	BOOK ACQUISITIONS				Serials Received (volumes)	Holdings 12/31/95
		Purchase	Exchange	Gift	Other		
General	105,163	179	38	117	31	450	105,978
Anthropology	38,056	168	36	66	51	120	38,497
Botany	31,975	62	15	122	27	130	32,331
Geology	36,520	57	13	12	11	170	36,783
Zoology	37,401	99	8	95	30	120	37,753
Birds	11,692	27	1	11	4	20	11,755
Mammals	4,201	34	0	7	3	15	4,260
Insects	14,576	14	3	11	4	60	14,668
Invert.	4,049	20	2	13	9	12	4,105
Fishes	1,091	12	0	11	1	8	1,123
Reptiles	1,792	14	2	42	9	5	1,864
Total	**249,115**	**565**	**110**	**412**	**150**	**990**	**251,342**

PHOTOGRAPHIC COLLECTIONS

The Photographic Collection serves as an important supplement to The Field Museum's exhibits and research, and increases the educational value of the artifacts and specimens. Associated collector's field notes and diaries also strengthen the importance of the Photographic Collection. Millions of people who have not visited Field Museum see our photographs in displays, textbooks, journals, magazines, and electronic media. Photographs are requested and republished, often with different uses for the same photograph. This cumulative effect increases the value of the Photographic Collection for many different disciplines.

Research and Other Scholarly Uses of the Collection

The Photography Department processes all outside photograph and usage requests from a variety of sources; publishers, teachers, students, commercial and public television as well as museums, universities, galleries and the general public. The photographs are used in textbooks, advertisements, educational programs, calendars, and posters. The Photographic Collection is also an important research resource for Museum scientists and curators. The Museum's monthly "In the Field," distributed to over 25,000 members, has also used the Photographic Collection repeatedly during its past 54 years.

The Photographic Collection is widely used in the Museum's exhibits and especially in the Webber Resource Center, where the peoples and cultures of North, Central, and South America are featured. Photographs show the people, environment, technology, architecture, religion, costumes, and food gathering and preparation activities. Records show that the use of photograph albums is extremely popular. Copies of prints are available for purchase through the Photography Department.

Contents and Historical Significance of the Collection

Native American Material

Between 1895 and 1910, the Museum collected most of its Native American ethnological and archaeological material to augment the collections obtained from the World's Columbian Exposition. Between 1897 and 1898, free-lance photographer Edward Allen and Museum curator George Dorsey documented the daily activities, ceremonies, and peoples of the Pacific Northwest Coast, and the plains, plateau, and desert regions of the western United States.

In 1899, Charles H. Carpenter was hired as the Museum's first full-time, professional photographer. He remained in that position until his retirement in 1947. Carpenter went with curators on several early expeditions including the 1900 Stanley McCormick-sponsored expedition which produced over 1,200 negatives of the Hopi Indian tribes. Carpenter and H.R. Voth, a missionary to the Hopi from 1893 to 1902, and ethnologist for the Field Columbian Museum, photographed daily activities and life of the villagers. Voth lived with the Hopi for more than years. Photographer Sumner Matteson, under the direction of Dorsey, added other photographs of the Hopi to the Collection. Soon after these photography excursions, the United States Government severely restricted the use of cameras on Hopi reservations, and eventually banned them entirely.

John W. Hudson spent his life as a collector-scholar, and amassed a significant number of California Indian baskets held by The Field Museum. The Smithsonian Institution, Brooklyn Museum, and Hudson Museum in Ukiah, California also have material collected by Hudson. Photographs in The Field Museum's possession document the native Pomo, Yurok, Miwok, and Hupa from 1900 to 1905 when Hudson was collecting artifacts under Dorsey's auspices. Hudson visited more than twenty tribes and photographed traditional activities such as basket-making, acorn-grinding, and other aspects of daily life. In many cases, these photographs are the only visual record of such activities. The Hudson collection contains over 450 negatives. J. W. Hudson's field notes and papers were deposited at the Sun House (also called the Hudson Museum). In an exchange of photographs, field notes, ongoing research, between the two institutions, Field Museum received detailed documentation of the Hudson photographs. A computerized catalogue of the photographs and artifacts was compiled by Field Museum Research Associate Eloise Richards Barter. Other strengths in the Collection of Native

American culture include Dorsey and Carpenter's photographs of Cheyenne life, Matteson's prints of the Blackfoot tribe, and S. C. Simms' Crow and Cheyenne photographs.

Carpenter and the Louisiana Purchase Exposition

In 1904, the city of St. Louis was host to an exposition held to celebrate the centennial of the Louisiana Purchase. There were over forty-seven acres of exhibits of Philippine and Native American tribes including Pawnee, Pueblo, Pima, Pomo, Kwakiutl, Eskimo, Oglala and Rosebud Sioux who recreated ceremonies and lived in native habitats on the Fairgrounds. The Fair was Carpenter's last field assignment for the Museum, and he made over 3,000 negatives, including portraits of Geronimo and Pacific Northwest Coast Natives Americans Bob Harris and Charles Nowell. Prints from Charles Carpenter's series of Native American portraits taken at the Louisiana Purchase Exposition were requested by the Oglala Lakota College archives. Field Museum sent more than 100 photographs, but lacked detailed caption information for all but a few. In return, the College provided the Museum with the names and family histories of sixty of the photographs' subjects.

A. B. Lewis and Melanesia

From 1909 to 1913, Museum curator A. B. Lewis became the first American to conduct systematic ethnological field research in Melanesia. During the course of his travels, Lewis collected more than 12,000 examples of Melanesian ethnological material. This is the largest American collection of such material, and is one of the world's largest collections from that area of the Pacific. Lewis created an extensive photographic record of the areas he visited. His photographs, numbering more than 2,000, represent over one hundred different societies in Melanesia, and have been used to catalogue and interpret his collections of artifacts. Many of Lewis' photographs have been displayed in Field Museum exhibits.

West African grassfields--Cameroon

Field Museum contains one of the finest collections of Cameroon artifacts from the West African grassfields. In the 1920's, Jan Kleykamp, representing the J .F. G. Umlauff Company in Hamburg, sold a collection of artifacts to The Field Museum. The purchase included 332 ethnological photographs taken in 1912 and have been attributed to a man named Schroeder (Geary 1988: 141). Like the A. B. Lewis photographs, Schroeder's images consist of village scenes and portraits that illustrate the use and social context of the artifacts. There is a growing interest by ethnographers for source materials on African history. The often complete destruction of photographic material held by German museums during two world wars makes Field Museum's Schroeder photographs of particular value to scholars of African art and culture.

Worcester Collection

During the 1920's, Museum curator Fay-Cooper Cole visited the Philippine Islands and Indonesia. Through a prominent Philippine official, Dean C. Worcester, Cole obtained over 200 prints of the area taken by Worcester's personal photographer. The Worcester Collection is an extremely important and untapped resource for the study of Philippine anthropology (in particular, the Nias region), and late colonial Philippine history. Cole also took more than 400 photographs while visiting other areas of Indonesia and the Philippines.

Laufer Collection

Berthold Laufer, Curator of Asian Ethnology, spent three years in China and Tibet in the 1920's while laying the foundation for the Museum's highly regarded collection of Asian material. The collection of negatives that Laufer made while in the Far East include photographs of important ceremonies, daily life, and portraits.

The Father of Modern Taxidermy - Carl Akeley

In the late 1800's, Carl E. Akeley collected and mounted animals for Field Museum, and revolutionized the art of taxidermy. None are more famous than the "Fighting African Elephants" on display in the Museum's Stanley Field Hall. Akeley made two separate trips to Africa in 1895 and 1906. Akeley was also a photographer, and made thousands of negatives of the trips including villages and native peoples. Some of these photographs were used by Akeley in mounting the mammals he collected.

Akeley's negatives show the capture of the Elephants, which were first displayed at Field Columbian Museum in 1908.

Rawson-Macmillan Subarctic Expedition

From 1926 to 1928, the Museum sponsored the interdisciplinary Rawson-Macmillan Subarctic Expedition. Assistant Curator of North American Ethnology and Archaeology, William Duncan Strong, led the anthropological expedition. Strong excavated archaeological sites during the summer months and studied the Naskapi Indians during the winter months. Joseph Field, son of then Museum president Stanley Field, was a member of the expedition and took several hundred photographs of the Naskapi and Labrador. Over 1,700 negatives were produced during the three year expedition.

Henry Field

Physical anthropologist Henry Field spent the period between 1928 and 1934 excavating and collecting material from the Sumerian-Akkadian capital of Kish and nearly 5,000 photographs of the excavations, and ethnological portraits of villagers were produced by Field or his associates. Field also took photographs of prehistoric caves in France and Spain, and gathered data from which sculptor Frederick Blaschke was able to create a series of nine life-sized "Prehistoric Man" dioramas still on display at Field Museum.

Other Museum Expeditions

During the early 1900's, the Department of Anthropology collected artifacts mainly on the North American continent, while the departments of Zoology, Geology, and Botany concentrated on collecting in Central and South America. Natural science materials were collected, but like Akeley's African photographs, there are also many of village scenes and portraits. Geological expeditions during this period focused on the western states of Colorado, Arizona and New Mexico.

Malvina Hoffman-Sculptor

In 1930, Stanley Field, the nephew of Museum Founder Marshall Field I, commissioned artist Malvina Hoffman to sculpt and cast bronze figures depicting the peoples of the world. "The Races of Mankind" is the largest singly-commissioned body of her work and consists of 104 busts, heads, and life-sized figures. In preparation for the exhibit, Hoffman and her husband, S. B. Grimson, traveled throughout the world to find authentic models for the sculptures. The resulting photographs from the trip appear in her two autobiographies, as well as in several publications about Hoffman. The original negatives (over 2,000) represent one of the most complete photographic records of her travels.

Historical Photographs at The Field Museum

The Photographic Collections document the construction of the present Museum building, and when this was completed in 1921, both the collections and equipment were transferred both by truck and train using five miles of railroad track between the old building in Jackson Park and the new Grant Park location. The entire moving operation was finished in 34 days and was fully documented by Charles H. Carpenter. During the 1930's, Carpenter also photographed the preparation and installation of exhibits and the activities of Works Progress Administration employees. Field Museum's roots lie in the Columbian Exposition and with the prominent Chicago families who helped to establish the Museum. The Collection contains important documentation concerning the growth of the city of Chicago and its history. Visitors to the Museum, staff related activities, and portraits continue to be an important part of the Collection's historical documentation. The Field family, who have played an active role in the Museum since 1893, is especially well represented through historical photographs in the Collection.

Photographs in the Botany, Geology and Zoology Departments

Negatives and slides of field work (expeditions) produced by and for the Botany, Geology and Zoology departments, between 1893 and about 1950, are housed in the Photography Department's Collection storage area. In the 1950s, curators and staff began to keep their own slides and negatives of field photography, and the Photography Department does not house these images. There have been two recent donations of curators' field work photography to the Department, and both included a database catalogue of the photographs. These databases are an essential part of the collections of photographs.

Botany Collection

Botany curator, J. Francis Macbride, made extensive photographic records of his expeditions to Peru and other parts of South America. The Botany Department holds Macbride's field notes and the photographs made on the expeditions correspond with the field notes.

In addition to the Botany Department's specimen type collections that are in the Herbarium, Field Museum houses an extensive botanical type photographic collection. J. Francis Macbride began the project in 1929 and during the ensuing years he visited several major European herbaria, and obtained photographs of more than 40,000 types and historically important sheets. This collection is especially important because it includes records of type specimens that no longer exist or were heavily damaged during World War II.

More than 62,000 type photo-negatives are stored in the Photography Department's "Negative Room" and represent about 20% of the space used in the room. The Botany staff receives requests from other herbaria and scientists, they pull the negatives, and the Photography Department staff makes prints of the negatives and returns both the prints and negatives to the Botany Department for distribution and refilling. New negatives are shot, processed and catalogued by Botany Department volunteers.

Frequently requested Botany images are dioramas such as *Welwitschia*, Illinois Woodland and Maine Coastal Reef and plant models from the former Hall 29. Photograph requests for contemporary field work are usually referred to the staff members who have extensive slide libraries of their work.

Geology Collection

E. S. Riggs, Geology Curator, also made an extensive photographic record of his trips to collect fossil vertebrate material from 1899-1930. It is estimated that the Photographic Collection contains approximately 4,000 plus negatives from Riggs' various trips. For scientific use, the Riggs' photographs have been used recently in the design, move and reconstruction of the "dinosaur" skeletons in Life Over Time and Teeth, Tusks and Tar Pits. Riggs' expedition photographs are among the images requested most frequently for curatorial and staff use in publications, lectures and preparation of mounted specimen and for the "outside" scientists, authors, publishers and television and movie productions.

Frequently requested images from Geology include the Charles Knight murals-- twenty-eight murals representing the first signs of geological life through the extinct prehistoric mammals, and the E. S. Riggs' collection. Other frequently requested images are: fossil vertebrate skeletons from the exhibits, the Carboniferous Forest diorama, Mazon Creek specimens, Gems, and meteorites.

Zoology Collection

The staff of the Museum, both scientific and exhibit departments use the Zoology collection of historical expeditions the most. However, both the Carl Akeley photographs and the Rawson-Macmillan Sub-Arctic expedition photographs have been used by Anthropologists, both in and outside the Museum. Included in the collection are several thousand negatives from approximately 100 expeditions conducted by the Museum from 1893-1940.

Frequently requested images from Zoology include dioramas, mounted specimens and Carl Akeley field photographs from the 1898 and 1905 African Expeditions, and photographs made on the Abyssian 1920s expedition with acclaimed wildlife artist Louis Agassiz Fuertes.

COLLECTIONS COMPUTERIZATION

Principal systems that are part of The Field Museum network are as follows:

1. DEC VAX 11/785 running the Unix 5.3 operating system. This system is principally used for research and collection management activities. It has two hundred twenty-four asynchronous serial ports operating at 9600 baud that are connected to terminals and printers, that provide low speed communications for the Scientific staff. C/base, a commercial 4GL relational database software product, is used to manage collection related information for Anthropology, Botany, Geology and Zoology (specifically, Divisions of Birds, Mammals, Amphibians and Reptiles, Invertebrates and Insects). It also serves as the main connection to Internet services, particularly e-mail via the museum's communications server.

2. DEC Prioris HX 5133DP Server running UnixWare 2.01. The system was ordered late in 1995 and is initially intended to replace the aged VAX 11/785(above) and facilitate our conversion from centralized to decentralized support of most collection related activities.

3. DEC DECsystem 5100 running the RISC Ultrix 4.3 operating system functions as the Museum's communication server. It routes mail to other museum systems and provides the full compliment of Internet services, including e-mail, telnet and ftp. We are also using this system as a gopher server for some staff. Additional plans for this system include support for asynchronous communications (modems and faxes). It supports TCP/IP, DECnet and Pathworks network protocols.

4. Sun SPARCclassic runs Solaris (Unix) 2.x operating system. This system is used principally as a "gopher" client/server in the Division of Fishes. It is connected to the Museum network for access to Internet and eventually to the MUSE system used for managing Fishes collection data. The Division of Fishes also has Novell 4.1 LAN that supports MUSE application software for collections management.

5. Sun SPARCstation 5 run Solaris (Unix) 2.x operating system. This system is used primarily for database needs of Michael Dillon in the Department of Botany; it is configured as a Gopher and Netscape client/server for Internet and as a Popmail server for E-mail.

All of these systems are connected through Ethernet cables. The DECsystem 5100 by virtue of its facility to run three network protocols is the link that allows users connected to any of these systems to interconnect and use services on any of the other systems including our T1 link to Internet, provided they have proper permissions.

Computerization: Department of Anthropology

All of the Anthropology collections are in a computerized database. All incoming specimens are entered into the database as they are accessioned and cataloged. Portions of the database are currently being verified and updated.

Computerization: Department of Botany

Mycology--Databasing of collections information is well advanced in several areas of the mycological holdings, including all new accessions since 1986, all types (including lichens) and fungi from selected mid-western states (Illinois, Indian, Michigan, Wisconsin). In addition all material from Costa Rica, associated with projects by Mueller and others are summarized in database form.

Bryophytes--Over the last decade the data for the John Child collection of New Zealand bryophytes, the Marko Lewis Hawaiian and South American collections, and the Mary Taylor herbarium have been entered in the Museum's cryptogamic collections database.

Economic Botany--All of the basic data for the Economic Botany collection are available in a computerized database.

Andean Botanical Information System--ABIS (Andean Botanical Information System) represents Field Museum's efforts coordinated by M. O. Dillon to provide collector information from the floristic and systematic investigations of the phanerograms of Andean South America. ABIS is developing a networked databased of specimen-label data for selected groups of Andean plants, including the flora of coastal Peru and Chile, floristic inventories montane forests of northern Peru, and monographic treatments providing searchable text and online images. The database derived from this endeavor will allow for the nearly instantaneous, automatic sorting of these data by a variety of criteria. Activities related to ABIS are coordinated with the Museum Informatics Project at the University of California at Berkeley and utilized a design developed for a similar project, SMASCH (Specimen Management System for California Herbaria).

Phanerogram Types--The Field Museum, the center for Flora of Peru, Flora of Guatemala, Flora of Veracruz, and Flora Costaricensis, houses over 2 million flowering plants collections. Over 32,000 are currently identified phanerogam types and one third have been entered into a computerized database. This project is ongoing and the database contains over 62,000 records of computerized label data, corresponding negatives, and publication information (see Taxon 35: 934. 1986). The Asteraceae records are being consulted and updated with additional label information, annotation history, barcodes, and image capture. The Asteraceae types should be available in 1996.

Berlin Negatives--The Field Museum houses an extensive collection of South American phanerogam type photographs. For decade beginning in 1929, the Field Museum's J. Francis Macbride visited all the major herbaria of the European continent (B, C, G, HAN, HGB, MA, P, and W) and his efforts resulted in quality photographs of over 40,000 types and historically important sheets, most of which were South American in origin. The importance of this collection is notable since it includes records from herbaria damaged or destroyed during World War II. These black and white images are being scanned and associated with the updated database records, including additional label information and annotation history. Some of the Berlin type photos are already available for viewing on the World WideWeb.

Lomaflor & Detbase--Access to collection label data of South American Andean plants within an integrated database management system will provide improved access to the collections on which much taxonomic work of Andean flora is based. The specimen-label information from over 7,400 collections from coastal Chile and Peru have been electronically captured (LOMAFLOR) and are initially available in a hierarchical browser. A comparable database project, DETBASE, contains over 10,000 collections from northern Peru (Departments Amazonas, Ancash, Cajamarca, Piura, Lambayeque, La Libertad, San Martin) and will initially be made available in an hierarchical browser and ultimately a manual flora. Both databases are being incorporated into information systems for detailed studies of correlation's between geographic distribution and habitat factors and easier identification of rare and endangered species. Regional and local checklists will be available through improved geographic access to the collections, and ABIS will be connected to specimen-label databases developed in other regions to examine the distributions of taxa whose total range is not confined to the Andes (e.g., Flora Mesoamericana, Peru Checklist).

Monographs and New Species Online--Monographic treatments and new species of Andean taxa are to be placed on the ABIS server, with the Nolanaceae serving as the prototype with 50 color images of flowers and habitats within coastal Chile and Peru. These sample images now reside in a sampler of ABIS photographs. It is planned that macromorphological data, keys to taxa, and pertinent bibliographic information will be online and in hypertext format to allow connections with protologues and images of type specimens, flowers, and habitats. It is expected that new and previously published Andean taxa will also be brought online.

Computerization: Department of Geology

Paleontology--All paleontology specimens currently being catalogued are entered into a computerized collections database (using custom software) on a distributed server-network with high-speed Internet interface. Approximately eighty percent of all catalogued specimens (all of the fossil mammal collection) are in the computerized database. A complete database also exists for the collections of the Mazon Creek biota.

Physical Geology--Approximately fifty percent of the Physical Geology collections -Mineralogy, Meteoritics, Gems, and Building Stones (a mini-collection of Economic Geology) are in the computerized database. Data entry for the petrology and economic collections has been postponed pending evaluation and reconfiguration of these collections.

Computerization: Department of Zoology

Amphibians and Reptiles--The original collection computerization project, begun in 1978 entailed the entry of 121,000 records from thirty-one handwritten catalogs. By mid-1980, all records--but not all fields of all records--had been entered. All original collection catalog data fields for the first 250,131 records have now been entered into the computer database. The result has been a significant increase in the Division's ability to provide the scientific community with information regarding the collections. In 1995 alone, nearly 4,600 pages of data output was generated to satisfy information requests. Since 1993. Up to this point verification of computerized collection data has only been initiated in response to incoming requests.

Birds--The bird collections recently have been computerized. The Field Museum's collection is the largest collection of birds to be computerized to date. All records are now in the computer database, and the Division is at the mid-point of a five year project aimed at verification of the database information through a specimen-by-specimen comparison.

Fishes--The specimen records of the ichthyology collection are completely computerized and the database is in the process of being verified. The local area computer network is run from a Pentium-based server that connects the MUSE database to sites throughout the Fish Division. Using MUSE for the database management system, records were entered from the collection catalogues and locality information was supplemented by detailed field notes where available. All loan documents are processed and specimen labels are generated using MUSE. MUSE is able to query the database, sort records by numerous user-defined criteria, and provide reports. In addition, the database is available for investigators through the Internet, using either Gopher or the World Wide Web. Current efforts are focusing on the verification of the accuracy of the database in order to provide better service to the ichthyological community. To reach that goal, every record in the database is being checked against the corresponding lot of fishes in the collection and discrepancies are being resolved whenever possible.

Insects--A species-level database of the pinned insect collection is complete for the two large beetle families Staphylinidae and Histeridae, which together account for about a third of all research use of the collection. This database of over 41,000 names includes records for more than 21,000 species and 630,000 specimens represented in The Field Museum collection. The forty-two fields for each record include data on the current scientific name, number of specimens, presence of types, and overall geographic distribution of each species. The 14,000 bulk Arthropod samples in fluid are cataloged in a separate database which can be used to generate labels for specimens removed from the samples. Loan transactions are also computerized. A general specimen-level database for the collection, as used in other divisions in Zoology, has not been implemented, but a special-purpose database on batflies and their hosts is largely complete. Specimen databases for spiders and local staphylinids in the collection have been designed but not yet implemented. Plans are also underway to make the species-level and bulk sample databases available via the Internet.

Invertebrates--Between March 1992 and August 1993, the data from more than 40,000 lots of the Leslie Hubricht Collection were computerized in a relational database on the museum's VAX computer. These data are available on the Internet via gopher and the World Wide Web. Ongoing database efforts are focusing on the Australian field collections of Alan Solem and recent accessions.

Mammals-- Standardized data representing the entire collection has been entered into a computer database. The dry collection and most of the wet collection has been verified through a specimen-by-specimen comparison with the database. Discussion is now under way on the best strategy for placing aspects of the database on-line.

A summary of geographic data from the vertebrate zoology databases follows.

Vertebrate Zoology Collections Size - Countries and Comparable Areas

	Fishes	Herpetology	Birds	Mammals	Total
USA	203960	49574	111151	23592	388277
East Indies	30097	52705	NA	NA	82802
Mexico	31231	30445	12272	5376	79324
Malaysia	22230	50517	1031	4748	78526
Belize	61957	689	77	1525	64248
Ecuador	56185	1142	3315	1636	62278
Colombia	30196	4566	13619	7042	55423
Peru	11006	6256	18168	11076	46506
Brazil	19675	2031	13602	3957	39265
Philippines	3899	7159	20093	6989	38140
Atlantic Ocean	36867	715	172	NA	37754
Venezuela	22374	824	6817	833	30848
Pacific Ocean	28432	2332	20	NA	30784
Panama	21690	4657	3181	962	30490
West Indies	11355	2991	14516	237	29099
Indian Ocean	26953	1314	35	NA	28302
India	4820	2097	15092	2595	24604
Bolivia	2823	561	10403	5937	19724
Kenya	8	635	14597	3446	18686
Chile	1152	6653	3025	7634	18464
Egypt	1731	4289	3315	9055	18390
China	2427	3994	5505	5995	17921
Costa Rica	8526	3363	4571	633	17093
Thailand	1315	10654	1735	521	14255
Canada	4950	476	7541	1230	14197
Australia	2370	6560	3204	1708	13842
Uganda	32	566	8689	2169	11456
Iran	69	1180	5441	3509	10199
Cameroon	53	762	8466	451	9732
Nepal	21	987	7270	1442	9720
Tanzania	68	1132	3167	2985	7352
Sudan	38	1250	2053	2952	6293
Taiwan	1393	4096	243	23	5755

Vertebrate Zoology Collections Size- States and Comparable Areas

	Fishes	**Herpetology**	**Birds**	**Mammals**	**Total**
Illinois	87809	5614	31070	1845	126338
California	13042	2048	14860	4377	34327
Wisconsin	23897	1142	3758	3381	32178
Florida	10512	2413	10289	475	23689
Texas	13213	4599	4506	698	23016
Missouri	12976	674	59	148	13857
New York	1624	5610	1653	116	9003
Connecticut	22	72	7773	18	7885
Mississippi	1272	2866	571	46	7675
Arizona	58	891	4915	1036	6900
North Carolina	950	3921	1393	60	6315
Kentucky	2034	420	162	33	5115
Arkansas	2733	1756	319	180	4988
Louisiana	2816	1360	500	230	4906
Alaska	188	11	3381	1162	4742
Michigan	3341	429	602	308	4681
Indiana	9664	2514	831	276	4617
Iowa	3631	232	191	66	4120
North Dakota	255	11	3539	220	4025
Tennessee	3684	1	124	183	3992
Washington	2380	482	467	552	3881
Hawaii	3261	374	30	4	3669
Virginia	791	1531	1087	27	3436
Colorado	83	315	1888	803	3089
Oregon	43	869	1691	438	3039
Georgia	557	1231	1048	147	2983
New Jersey	48	71	2733	129	2981
Minnesota	836	173	1487	424	2920
South Carolina	1118	807	612	62	2599
Kansas	5	1561	749	151	2499
New Mexico	0	446	1356	697	2499
Massachusetts	239	38	1850	14	2141
Oklahoma	158	1412	164	270	2004
Idaho	28	153	1256	229	1666
Maine	758	14	738	89	1599
Utah	44	288	587	381	1300
Nebraska	803	103	134	225	1265
Ohio	816	186	127	47	1176
Montana	93	15	799	171	1078
Alabama	382	418	260	1	1061
Wyoming	367	46	318	192	923
Pennsylvania	53	268	495	16	832
Maryland	310	328	0	0	638
Nevada	15	49	124	419	607
South Dakota	73	95	123	167	458
West Virginia	5	137	109	162	413
Vermont	24	70	16	11	121
District of Columbia	11	4	83	0	98
New Hampshire	0	12	73	9	94
Delaware	7	74	12	0	93

Vertebrate Zoology Collections Size- States and Comparable Areas (cont.)

	Fishes	Herpetology	Birds	Mammals	Total
Rhode Island	1	0	49	1	51
Bering Sea	0	0	0	1	1
Northwest	0	0	0	0	0
Upper Mississippi Valley	0	0	0	0	0

Vertebrate Zoology Collections Size - Illinois Counties

	Fishes	Herpetology	Birds	Mammals	Total
Cook Co.	9590	2031	23431	633	35685
Will Co.	15326	172	461	30	15989
McHenry Co.	10140	174	64	1	10379
Lake Co.	5175	1376	1533	351	8435
Jo Davies Co.	6491	11	12	22	6536
DuPage Co	2259	288	980	143	3670
DeKalb Co.	2514	1	1087	0	3602
Champaign Co.	3175	8	3	15	3201
Grundy Co.	2662	65	9	0	2736
Vermilion Co.	2695	1	5	5	2706
Edgar Co.	2687	3	3	0	2693
Kane Co.	1833	96	278	15	2222
Boone Co.	2189	0	10	0	2199
Stephenson Co.	1905	3	4	0	1912
Ogle Co.	1475	27	113	3	1618
LaSalle Co.	1548	15	27	26	1616
Kankakee Co.	1244	51	139	39	1473
Winnebago Co.	1365	4	59	1	1429
Macoupin Co.	930	44	55	3	1032
Carroll Co.	878	27	27	4	936
Monroe Co.	819	35	5	1	860
Ford Co.	770	1	2	0	773
Morgan Co.	656	56	12	1	725
Alexander Co.	19	196	155	169	539
Effingham Co.	514	0	1	0	515
Mason Co.	302	201	7	5	515
Massac Co.	487	3	7	0	497
Saline Co.	453	24	0	0	477
Iroquois Co.	473	2	1	0	476
Christian Co.	427	2	22	2	453
Cass Co.	422	4	3	0	429
Macon Co.	416	0	0	0	416
Coles Co.	405	9	0	0	414
McLean Co.	406	1	5	0	412
Pulaski Co.	0	2	393	0	395
Lee Co.	331	11	39	1	382
Hardin Co.	204	9	0	115	328
Union Co.	74	218	6	28	326
Randolph Co.	253	4	0	0	257
Clark Co.	251	1	0	0	252
Whiteside Co.	233	5	13	0	251
Shelby Co.	236	0	0	0	236
Kendall Co.	206	12	10	4	232
Fulton Co	28	18	175	2	223
Jasper Co.	213	2	6	2	223
Marshall Co.	1	7	194	2	204
Pope Co.	101	60	3	38	202
Jackson Co.	22	90	73	8	193

Vertebrate Zoology Collections Size - Illinois Counties (cont.)

	Fishes	**Herpetology**	**Birds**	**Mammals**	**Total**
Douglas Co.	186	0	0	0	186
Sangamon Co.	141	2	4	6	153
Wabash Co.	144	0	1	0	145
Tazewell Co.	132	0	0	1	133
Henry Co.	0	1	127	2	130
Peoria Co.	96	2	1	12	111
Madison	84	12	7	0	103
Johnson Co.	0	4	0	80	84
Menard Co.	69	0	3	1	73
Hancock Co.	0	8	42	17	67
Crawford Co.	64	0	0	0	64
Cumberland Co	4	51	0	0	55
Woodford Co.	53	2	0	0	55
Clay Co.	53	0	0	0	53
Gallatin Co.	46	1	0	0	47
Rock Island Co	41	2	2	0	45
Porter Co.	0	0	0	38	38
Williamson Co.	34	2	1	0	37
DeWitt Co.	31	1	0	0	32
Richland Co.	0	23	3	5	31
Adams Co.	1	22	3	4	30
Putnam Co.	0	7	16	1	24
Fayette Co.	14	1	6	0	21
Bureau Co.	0	12	6	1	19
Warren Co.	0	18	0	0	18
Jersey Co.	4	10	0	0	14
Moultrie Co.	14	0	0	0	14
Piatt Co.	11	1	0	0	12
Pike Co.	0	5	7	0	12
St. Clair Co.	0	7	3	0	10
Calhoun Co.	0	2	6	0	8
Logan Co.	0	2	5	0	7
Marion Co.	2	0	3	2	7
Knox Co.	0	3	1	1	5
Jefferson Co.	1	1	0	2	4
Livingston Co.	0	1	3	0	4
Clinton Co.	0	0	3	0	3
Mercer Co.	0	3	0	0	3
Schuyler Co.	0	1	2	0	3
Washington Co	0	0	3	0	3
Bond Co.	0	0	2	0	2
Brown Co.	0	0	2	0	2
Franklin Co.	0	1	0	1	2
Greene Co.	0	2	0	0	2
Lawrence Co.	0	1	1	0	2
Makapan Co.	0	0	0	2	2
McDonough Co	0	0	2	0	2
Columbia Co.	0	0	0	1	1
Henderson Co.	0	0	1	0	1
Lacon Co.	0	0	1	0	1
Montgomery C	0	1	0	0	1
Stark Co.	0	0	1	0	1

J. WILLIAM O. BALLARD

Assistant Curator, Insects, Department of Zoology; Committee on Evolutionary Biology, University of Chicago, Visiting Scientist, Commonwealth Scientific and Industrial Research Organization, Australia

B.Sc. (Hons)., Zoology, Australian National University, Canberra, Australia. 1982.
M.Sc./DIC., Pest Management, Imperial College, London, England. 1986.
Ph.D., Entomology University of Queensland, Brisbane, Australia. 1991.

Commonwealth Scientific and Industrial Research Organization (CSIRO) Postdoctoral Fellow. Entomology, 1991-1993.
National Health and Medical Research Council C.J. Martin Postdoctoral Fellow. University of Chicago and CSIRO, 1993-1995.

Molecular and cytological evolution in arthropods, host-parasite co-evolution.

The pattern and process of evolution can be studied as distinct fields of research, yet the two disciplines are intimately related, and progress in one facilitates studies in the other. For instance, phylogenetic knowledge is essential for determining the order of changes in a study investigating the neutral hypothesis of evolution. And conversely, knowledge of the pattern and rate of change of a given molecule is crucial in attempts to reconstruct evolutionary history. My research unites pattern and process by using phylogenetics as a tool to "root" my inferences of evolutionary change.

I would be pleased to supervise students interested in applying biochemical, cytological or morphological data to interesting questions in arthropod evolution, or pursuing projects on computational evolution. The Field Museum Biochemistry Laboratories, were recently upgraded by NSF renovation and equipment grants. The labs are now a state-of-the-art facility with an Applied Biosystems 377 automated sequencer.

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1991. (with M. P. Zalucki and K. E. Basford) Colonization of perspex strips by larvae of *Austrosimulium bancrofti* (Taylor) (Diptera: Simuliidae), near Ipswich, Queensland. Hydrobiologia 218: 255-263.

1991. (with D. G. Bedo) Population cytogenetics of *Austrosimulium bancrofti* (Taylor) (Diptera: Simuliidae) in eastern Australia. Genome 34: 338-353.

1992. (with G. J. Olsen, D. P. Faith, W. A. Odgers, D. M. Rowell and P. W Atkinson) Evidence from 12S ribosomal RNA that onychophorans are modified arthropods. Science 258: 1345-1348.

1994. (with M. E. Kreitman) Unraveling selection in the mitochondrial genome of *Drosophila*. Genetics 138: 757-772.

1994. (with D. P. Faith). Length differences and topology-dependent tests: A response to Kallersjo et al. Cladistics 10: 57-64.

1995. (with M. E. Kreitman) Is mitochondrial DNA a strictly neutral marker? TREE 10: 485-488.

FRED R. BARRIE

Visiting Assistant Curator, Vascular Plants, Department of Botany, Field Museum; Assistant Curator, Missouri Botanical Garden, St. Louis.

B.G.S., University of Michigan, 1976.
B.S., Biology, Metropolitan State College, Denver, 1979.
M.S., Botany, Washington State University, 1981.
Ph.D., Botany, University of Texas at Austin, 1990.

Research Fellow, Department of Botany, The Natural History Museum, London.
Secretary, Special Committee on Lectotypification of the XVth International Botanical Congress.
Editorial Committee, The International Code of Botanical Nomenclature.
Botanical Curator and member of the Curatorial Collections Committee, The Linnean Society of London, 1990-1993.

Systematics of *Valeriana*, particularly New World; Mesoamerican Floristics; Botanical Nomenclature; Typification of Linnaean and other 18th Century plant names.

Research includes studies of the systematics of the genus *Valeriana* and other Valerianaceae, particularly in the New World, and the Flora Mesoamericana Project. A collaborative venture of the Missouri Botanical Garden, the Universidad Autónoma de México and the Natural History Museum, London, the Project is producing a modern, comprehensive flora for Panama, Central America and México east of Oaxaca and Veracruz. Volume six (monocots) was published in 1994, volume one (pteridophytes) in 1995. The remaining five volumes will be published by 2000. The Searle Herbarium is a vital resource for any floristic account of mesoamerica, as it contains one of the largest and most comprehensive mesoamerican plant collections.

Prior to arriving at The Field Museum, I spent five years at the Natural History Museum, London, collaborating with Dr. Charles Jarvis on the Linnaean Plant Name Typification Project. The Linnaean Project's goal is to identify, evaluate and catalogue the potential type material for the 10,000 plant names published by Carl Linnaeus. The results will appear in an annotated catalogue and in a computerized database which will be available on-line. In 1993, we published a list of the 1300 Linnaean generic names and their types, including the first effective typifications for 451 names.

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1989. The neotypification of *Valeriana scandens* L. (Valerianacae). Taxon 38: 296-298.

1989. Two new species of *Valeriana* (Valerianaceae) from Cerro de Teotepec, Guerrero, Mexico. Sida 13: 265-272.

1991. (with J. L. Reveal and C. E. Jarvis) Proposals to permit the designation of an authenticating element to allow the precise interpretation of an ambiguous type. Taxon 40: 667-668.

1993. (with L. J. Dorr) Typification of Linnaean names in *Pyrola* (Ericaceae, Pyroloideae). Brittonia 45: 177-180.

1993. (with C. E. Jarvis, D. M. Allan and J. L. Reveal) A list of Linnaean generic names and their types. Regnum Vegetabile 127: 1-100.

1994. (with W. Greuter, H. M. Burdet, W. G., Chaloner, V. Demoulin, D. L. Hawksworth, P. M. Jørgensen, J. McNeill, D. H. Nicolson, P. C. Silva and P. Trehane) (eds.) The International Code of Botanical Nomenclature, Adopted by the Fifteenth International Botanical Congress, Yokohama, August—September 1993. Regnum Vegetabile. 131: 1-395.

JOHN M. BATES

Assistant Curator, Department of Zoology, Field Museum

B.S., University of Arizona, 1983.
M.S., University of Arizona, 1987.
Ph.D., Louisiana State University, 1993.

Systematics, genetic structure, and geographic variation in birds

My research focuses on genetic structure of Neotropical birds, primarily at the level of populations and species. At a continental scale, I use data from DNA sequences to uncover patterns of history among lineages of Amazonian and Andean birds. Multi-taxon studies, in which samples of different taxa are obtained at each geographic site, provide insightful comparative data sets. Coupled with an understanding of distribution and ecology, I can search for correlations between molecular differentiation and other aspects of the biology of these birds such as morphological differentiation, ecology (e.g., habitat selection, foraging guild membership, breeding system, degree of seasonal movement) and phylogenetic relationships (phylogenetic constraints). In addition, to addressing evolutionary questions, these distinct patterns of genetic structure can have relevance to conservation biology.

At the local geographic scale, I have studied genetic structure in populations of five forest understory species from continuous forest and from forest fragments in northeastern Bolivia. The sites in continuous forest and the forest fragments are all within 200 km of one another, yet genetic differentiation appears to have developed in the forest fragments for three of the species studied. This work also implications for the design of nature reserves and for conservation planning, because my data indicate that genetic structure in these forest species can be affected by forest fragmentation.

In addition, I study geographic variation using traditional museum specimens and computerized databases. I recently completed a study of geographic variation in some South American finches which uncovered misconceptions about traditional species limits and diagnosable populations. Such studies demonstrate the vital importance of museum collections and, along with results of molecular studies, emphasize that additional inventory work on birds is sorely needed.

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1988. (with G. S. Mills, and J. B. Dunning, Jr.) Effects of urbanization on breeding bird community structure in southwestern desert habitats. Condor 91: 416-428.

1992. (with T. A. Parker, III, A. P. Capparella and T. J. Davis) Observations on the *campo*, *cerrado*, and forest avifaunas of eastern Dpto. Santa Cruz, Bolivia, including 21 species new to the country. Bulletin of the British Ornithological Club 112 (:86-98.

1992. Frugivory on *Bursera microphylla* (Burseracae) by wintering Gray Vireos (*Vireo vicinior*, Vireonidae) in the coastal deserts of Sonora, Mexico. Southwestern Naturalist 37(3): 252-257.

1992. (with R. M. Zink) Seasonal variation in gene frequencies in the House Sparrow (*Passer domesticus*). Auk 109(3): 658-662.

1993. (with S. J. Hackett, and R. M. Zink) Tecnicas y materiales para la preservación de tejidos congelados. Pp. 75-78. In: P. Escalante-Pliego (ed.), Curación moderna de colecciones ornitolólogicas. American Ornithologists' Union, Washington, D. C.

1994 (with R. M. Zink) Evolution into the Andes: species relationships in the flycatcher genus *Leptopogon*. Auk 111(3): 507-515.

1995. (with S. J. Hackett, C. S. Griffiths, N. K. Klein) A commentary on the use of sequence data for phylogeny reconstruction. Molecular Phylogenetics and Evolution 4(3): 350-353.

RÜDIGER BIELER

Associate Curator and Head, Invertebrates, Department of Zoology, Field Museum; Lecturer, Committee on Evolutionary Biology and Biological Sciences Collegiate Division, University of Chicago.

M.Sc., Biology, Geography and Biology-Education, University of Hamburg, 1982.
Ph.D., Zoology, University of Hamburg, 1985.

Research Associate of Malacology, Museum of Comparative Zoology, Harvard University.
President-Elect, American Malacological Union.
Secretary, Council of Systematic Malacologists.
Editor-in-Chief, Monographs of Marine Mollusca, Nemouria.
Scientific Editor, Smithsonian Institution Translations Publishing Program.
Editorial Board Member: Malacologia, International Journal of Malacology; Malacological Review; The Nautilus.
Coordinating Author, Treatise on Invertebrate Paleontology.
Trustee, Board of Directors, Delaware Museum of Natural History.

Evolutionary biology of mollusks, especially Gastropods.

Research concentrates on the evolution, comparative anatomy, zoogeography and reproductive biology of gastropods (snails). Emphasis is placed on the currently unresolved "higher-level" phylogenetic relationships between various gastropod orders and subclasses. How are the marine shell-bearing snails, the sea slugs and the land snails interrelated? Where do they come from? Does the fossil record corroborate our hypotheses? Data are collected by employing a combination of field and laboratory techniques (ranging from collecting by SCUBA diving to serial-section histology and DNA sequencing), and are derived in part from Field Museum's extensive holdings of Recent and fossil mollusks. More narrowly defined subprojects deal with a group of marine snail families called "Heterostropha." These are not only of interest due to their unusual anatomical features and still uncertain relationships to other snail groups, but their long-range larval distribution and excellent fossil record also allows to address general biological questions such as: How does a high-dispersal marine invertebrate animal speciate? Also continuing is monographic work on worm-snails (an enigmatic group that includes important reef builders in the world's oceans), forming the basis for future phylogenetic and zoogeographic studies.

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1988. Phylogenetic relationships in the gastropod family Architectonicidae, with notes on the family Mathildidae (Allogastropoda). Malacological Review, Supplement 4: 205-240.

1990. (with K. J. Eckelbarger and P. M. Mikkelsen) Ultrastructure of sperm development and mature sperm morphology in three species of commensal bivalves (Mollusca: Galeommatoidea). Journal of Morphology 205: 63-75.

1992. Gastropod phylogeny and systematics. Annual Review of Ecology and Systematics 23: 311-338.

1992. (with P. M. Mikkelsen) Biology and comparative anatomy of three new species of commensal Galeommatidae, with a possible case of mating behavior in bivalves. Malacologia 34:1-24.

1992. (with P. M. Mikkelsen) (eds.) Handbook of Systematic Malacology, Parts 1-2. Smithsonian Institution and National Science Foundation, 1189 pp. (Annotated English-language edition of Thiele, J., Handbuch der systematischen Weichtierkunde Teile 1-2).

1993. Architectonicidae of the Indo-Pacific (Mollusca: Gastropoda). Abhandlungen des Naturwissenschaftlichen Vereins in Hamburg/Stuttgart (NF) 30: 1-376 New York: G. Fischer Verlag.

JOHN R. BOLT

Curator, Fossil Reptiles and Amphibians, Department of Geology, Field Museum; Lecturer, Committee on Evolutionary Biology, University of Chicago; Associate Professor, University of Illinois at Chicago.

B.S., Geology, Michigan State University, 1962.
Ph.D., Paleozoology, University of Chicago, 1968.

Chair, Department of Geology, Field Museum of Natural History, 1981-1990.
Treasurer, Society of Vertebrate Paleontology, 1993-present.

Early diversification of tetrapods, particularly amphibians, of Mississippian, Pennsylvanian, and Early Permian age (ca. 360 to 270 million years before present)/systematics/comparative and functional morphology/biogeography.

Current studies are focused on: i) Relationships and morphology of primitive amphibians (as well as fish) from a Mississippian (ca. 335 million years before present) locality in southeastern Iowa. The locality has produced hundreds of specimens of the oldest tetrapods known from continental North America. Complete specimen preparation will require several years. ii) Continuing development of an interactive World Wide Web site for systematic data, which was implemented in 1995 with two colleagues, from the U.S. and U.K. The site is currently accessible at http://www.bsd.uchicago.edu/Staff/bart/PRESERVE/manager.cgi. iii) Fossil evidence for the origin and early evolution of the tetrapod auditory system, and its implications for otic evolution as well as tetrapod relationships. iv) Origin and early evolution of the living amphibians (lissamphibians). I am interested in supervising student research on systematics, morphology, and biogeography of Paleozoic reptiles and amphibians.

* * *

1985. (with R. E. Lombard) Evolution of the amphibian tympanic ear and the origin of frogs. Biological Journal of the Linnean Society 24: 83-99.

1988. (with R. E. Lombard) Evolution of the stapes in Paleozoic tetrapods: conservative and radical hypotheses. Pp. 37-67. In: B. Fritzsch, M. J. Ryan, W. Wilcznski, T. E. Hetherington and W. Walkoviak (eds.), The Evolution of the Amphibian Auditory System. John Wiley and Sons, Inc.

1988. (with R. M. McKay, B J. Witzke and M. P. McAdams) A new Lower Carboniferous tetrapod locality in Iowa. Nature 333: 768-770.

1990. Tetrapods and fish from a recently-discovered Middle Mississippian locality in Iowa. National Geographic Research 6: 339-354.

1991. Lissamphibian origins. In: H.-P. Schultze and L. Trueb (eds.), Tetrapod Origins. Cornell University Press.

1992. (with R. E. Lombard) Nature and quality of the fossil evidence for otic evolution in early tetrapods. Pp. 377-403. In: A. Popper, R. Fay and D. Webster (eds.), The Evolutionary Biology of Hearing. Springer Verlag.

1995. (with D. S. Berman, R. R. Reisz and D. Scott) The cranial anatomy and relationships of the synapsid *Varanosaurus* (Eupelycosauria: Ophiacodontidae) from the Early Permian of Texas and Oklahoma. Annals of Carnegie Museum 64: 99-133.

1995. (with R. E. Lombard) A new primitive tetrapod, *Whatcheeria deltae*, from the Lower Carboniferous of Iowa. Palaeontology 38: 471-494.

BENNET BRONSON

Curator, Asian Archaeology and Ethnology and Chair, Department of Anthropology, Field Museum; Adjunct Professor, Anthropology Department, University of Illinois at Chicago; Adjunct Professor, Center for Southeast Asian Studies, Northern Illinois University; Research Associate, Center for East Asian Studies, University of Chicago.

B.A., Harvard University, 1960.
Ph.D., University of Pennsylvania, 1976.

Editorial Advisory Board, Archaeology Magazine, 1981-92.
Editorial Board, Archeomaterials, 1986-93.
Co-Director, Program for Ancient Settlement and Trade in Thailand (PASTT), 1988-93.

Economic and social evolution, with special reference to early technology and trade in Asia.

The ancient world had surprising similarities to our own in terms of the importance of commercial competition, the effects of technological progress, and the causes of economic development and decline. In line with these interests I have been involved for a number of years in a program of archaeological and ethnographic work in Asia combined with research on the Asian collections of The Field Museum. I have collaborated with several specialists outside the museum on studies of early metallurgy in Southeast Asia and China. With my in-museum colleague, Adjunct Assistant Curator Chuimei Ho, I have now completed most of the analysis and writing-up of excavations jointly conducted by The Field Museum and the Thai Fine Arts Department at ancient seaports in southern Thailand. This has thrown new light on patterns of early international trade. In extension of these investigations, I will be participating in a three year project headed by Chuimei Ho, focusing on the early ceramic and metal industries of Southeast China and the export trade in those materials.

I am also engaged in several smaller collections-oriented research projects. These include studies of Chinese and Japanese bronze objects dating to AD 1400-1900, of Chinese and Indonesian pigeon and cricket keeping, of East and Southeast Asian textiles, of early glass and glaze chemistry, and of Indonesian-Philippine ethnographic art. At present I am supervising research by students from two local universities.

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1986. The Making and Selling of Wootz, a Crucible Steel of India. Archaeomaterials 1(1): 13-51.

1987. Terrestrial and Meteoric Iron in the Indonesian Kris. Journal of Historical Metallurgy 221: 8-15.

1988. (with P. Charoenwongsa) The Stone and Metal Ages of Thailand Monographs in Thai Antiquity, Vol. 1. Thai Archaeology Working Group, Bangkok. 135 pp.

1990. (with W. Rostoker) Pre-Industrial Iron: Its Technology and Ethnology. Archeomaterials Press, Philadelphia. 234 pp.

1991. Export Porcelain in Economic Perspective: The Asian Ceramic Trade in the 17th Century. Pp. 126-151, In: C.M. Ho (ed.), Ancient Ceramic Kiln Technology in Asia. Centre of Asian Studies, University of Hong Kong.

1992. (with J.C. White) Radiocarbon and Chronology in Southeast Asia Pp. 491-504 (vol. 1) and Pp. 475-515 (vol. 2) In: R. Ehrich (ed.), Radiocarbon and Chronology in the Old World, 3rd ed.

WILLIAM C. BURGER

Curator, Vascular Plants, Department of Botany, Field Museum.

B.A., Columbia University, 1953.
M.Sc., Cornell University, 1958.
Ph.D., Washington University, 1961.

Chair, Department of Botany, Field Museum of Natural History, 1978-1985.

Flora of Costa Rica/speciation and species richness in Costa Rican flowering plants/early evolution of angiosperms and processes of angiosperm diversification.

The Flora Costaricensis is an encyclopedia-like review of the native and naturalized plants of Costa Rica, with keys, illustrations, descriptions and short discussions. It is published in parts, each covering a single large family or several smaller families. The work attempts to define and characterize the species and facilitate user identification.

The flowering plants of Costa Rica probably number close to 10,000 species, packed into an area about the size of West Virginia. Taxonomic review of many unrelated families has disclosed repeated geographic and altitudinal patterns, while making it clear that closely related species rarely grow in the same habitat. Analysis of these patterns may give us insights into the speciational processes that have helped produce so rich a flora.

The early evolution of angiosperms is poorly understood, while the origin of angiosperms is still as much an "abominable mystery" as when Darwin so described it. Current thinking about early angiosperm evolution continues a tradition of more than 50 years and is virtually unanimous. By exploring radically different scenarios it may be possible to develop new insights into early morphological trends, or at least challenge the confidence of current thinking in the field.

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1978. The Piperales and the monocots: alternate hypotheses for the origin of monocotyledonous flowers. Botanical Review 43: 345-393.

1981. Heresy revived: the monocot theory of angiosperm origin. Evolutionary Theory 5: 189-225.

1985. Why are there so many kinds of flowering plants in Costa Rica? Pp. 125-136. In: W.G. D'Arcy and M.D. Correa, (eds.), The Botany and Natural History of Panama. Missouri Botanical Garden, St. Louis.

1989. Tropical forests and the number of plants and animals on planet earth. Field Museum Bulletin 1: 8-14.

1990. (with H. van der Werff) Flora Costaricensis: Lauraceae and Hernandiaceae, Families 80 and 81. Fieldiana: Botany, n. .s. 23: 1-138.

1992. Parapatric close-congeners in Costa Rica: Hypotheses for pathogen-mediated plant distribution and speciation. Biotropica 24: 567-578.

1993. (with Charlotte Taylor) Flora Costaricensis: Rubiaceae, Family 202. Fieldiana: Botany n.s. 33: 1-333.

BARRY CHERNOFF

Associate Curator, Fishes, Chair, Department of Zoology, Field Museum; Lecturer, Committee on Evolutionary Biology, University of Chicago; Adjunct Professor of Neotropical Zoology, Universidad Central de Venezuela.

B.A., State University of New York at Stony Brook, 1973.
M.A., Adelphi University, 1976.
Ph.D., University of Michigan, 1983.

Board of Governors, American Society of Ichthyology and Herpetology, 1985-1989, 1991-1996.
Governing Council, Society of Systematic Biology, 1993-1997.
Visiting Professor of Neotropical Zoology, Universidad Central de Venezuela, 1988.
Book Review Editor, Systematic Zoology, 1987-1989.

Systematic biology of South American freshwater fishes and silverside fishes of the world/morphometrics/morphological evolution/systematics/biogeography.

My research is concerned with understanding the patterns and processes involved in morphological evolution. To do this, I integrate phylogenetic studies of fishes with morphometric studies of development in an attempt to evaluate current evolutionary theories. The fishes that I focus on are silverside fishes of the world (Atherniformes) and the selected groups of characiform fishes that live in the fresh waters of South America. These fishes offer an unusual opportunity to study morphological evolution across a variety of habitats and environments. The morphologies of these fishes are often highly influenced by the habitats within which they live. Part of my research focus, therefore, is to elucidate the patterns of morphological diversity that are due to phylogenetic (historical) factors and the patterns that are due to environmental influences. These studies emphasize general questions about morphological evolution, such as the evolution of complexity, character stasis and the relationship between genetic and developmental evolutionary models.

I would be pleased to supervise students interested in applying developmental, morphological or biochemical data to the resolution of interesting questions in fish evolution and systematics or pursuing projects on morphological evolution in other organisms. The Field Museum has excellent collections of recent fishes, with strong emphases on neotropical freshwater fishes as well as biochemical and morphometrics/image analysis laboratories for use in systematic and evolutionary studies.

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1985. (with F. L. Bookstein, R. L. Elder, J. M. Humphries, G. R. Smith and R. E. Strauss) Morphometrics in Evolutionary Biology. The Geometry of Size and Shape Change, with Examples from Fishes. Academy of Natural Sciences Special Publication No. 15: 1-277.

1990. (with A. Machado) Characid fishes of the genus *Ceratobranchia*, with descriptions of new species from Venezuela and Peru. Proceedings of the Academy of Natural Sciences, Philadelphia 142: 261-290.

1991. (with A. Machado and W. G. Saul) Redescription of *Leporinus brunneus* Myers (Characiformes: Anostomidae) with a biogeographic analysis of the fish fauna of the Upper Rio Orinoco. Ichthyological Explorations of Freshwaters 2 (1): 295-306.

1992. (with J. G. Lundberg) A Miocene fossil of the amazonian fish *Arapaima* (Teleostei, Arapaimidae) from the Magdalena River region of Colombia — biogeographic and evolutionary implications. Biotropica 24 (1): 2-14.

1993. (with A. Machado, P. A. Buckup, and R. Royero) Las especies del genero *byconops* Kner, 1858 en Venezuela. Acta Biologic Venezuelica 14(3): 1-20.

1994. (with A. Machado, P. A. Buckup, and R. Royero) Systematic status and neotype designation of *Autanichthys giacopinnii* Fernandez-Yepez with comments on the morphology of *Bryconops melanurus* (Bloch). Copeia 1994 (1): 238-242.

PETER R. CRANE

Vice President, Academic Affairs and A. Watson Armour III, Curator, Departments of Botany and Geology, Field Museum; Professor, Department of the Geophysical Sciences, University of Chicago; Lecturer, Committee on Evolutionary Biology, University of Chicago.

B.Sc., Botany, University of Reading, 1975.
Ph.D., Paleobotany, University of Reading, 1981.

Post-doctoral Research Scholar, Indiana University, 1981-1982.
Schuchert Award, Paleontological Society, 1993.
Bicentenary Medal of the Linnean Society of London, 1984.
Visiting Professor, Bot. Garten und Inst. für Systematische Botanik der Universität Zürich, 1987.
Visiting Professor, Botany Department, University of Massachusetts, 1989.
Visiting Research Fellow, The Natural History Museum, London, U.K.
Senior Mellon Fellow, Smithsonian Institution.
Editorial Board, Review of Palaeobotany and Palynology.
Editorial Board, Plant Systematics and Evolution.
Editorial Board, International Journal of Plant Sciences.
Editor, Paleobiology, 1984-1986.

Paleobotany of land plants, particularly the origin and early evolution of angiosperms.

My research focuses on the paleobotany of land plants and the application of paleobotanical data to understanding large-scale phylogenetic and macroevolutionary patterns in the Plant Kingdom. The early evolution of angiosperms and associated patterns of Cretaceous vegetational change continue to be my primary interest. Other areas of ongoing research include the initial diversification of land plants, the origin of seed plant biology and evolution of water-conducting tissues. Recent work involved field studies in eastern North America and central Portugal, and has recovered well-preserved microscopic flowers of early angiosperms and related plants from the mid-Cretaceous (about 100 myr B.P.). Scanning electron microscopy of this material is providing morphological and systematic data, as well as insights into pollination and other aspects of reproductive biology in early angiosperms. Studies of pollen grains preserved in situ within flowers also provide a more secure basis for ecological interpretations of the fossil palynological record. These studies and associated syntheses of Cretaceous palynological data are designed to improve understanding of the large-scale biotic and environmental changes that occurred during the critical mid-Cretaceous phase of Earth history.

I will be pleased to supervise students interested in the higher-level systematics and phylogeny of extant or fossil plants, or who wish to apply paleobotanical data to interesting questions in plant evolution or vegetational history.

* * *

1985. Phylogenetic analysis of seed plants and the origin of angiosperms. Annals of the Missouri Botanical Garden, 72: 716-793.

1987. (with E. M. Friis and W. G. Chaloner) (eds.) The Origins of Angiosperms and their Biological Consequences. Cambridge: Cambridge University Press, x + 337 pp.

1989. (with S. Blackmore) (eds.) Evolution, Systematics and Fossil History of the Hamamelidae. Volumes 1 and 2. Oxford: Oxford University Press.

1989. (with S.H. Lidgard) Paleolatitudinal gradients and temporal trends in Cretaceous floristic diversity. Science, 246: 675-678.

1991. (with P. Kenrick) Water-conducting cells of early fossil land plants: Implications for the early evolution of tracheophytes. Botanical Gazette 152: 335-345.

1995 (with E. M. Friis and K. R. Pedersen) The origin and early diversification of angiosperms. Nature.

WINIFRED CREAMER

Adjunct Associate Curator, Northern Rio Grande Research Project, Department of Anthropology, Field Museum; Associate Professor, Department of Anthropology, Northern Illinois University

Ph.D., Tulane University, 1983.

Evolution of cultural systems with a focus on archaeology of the southwestern U.S.

In 1995 I was promoted to Associate Professor of Anthropology at Northern Illinois University, where I continue to study regional demography of the Pueblo people of New Mexico during the Protohistoric period (AD 1450-1680). Research focused on collecting data that is being used to estimate regional population at 50-year intervals through the protohistoric. Presentations at professional meetings discussed change in ceramic production as a response to colonial settlement in New Mexico, and the antiquity of inter-village warfare in northern New Mexico, and its possible effects on Pueblo population.

Undergraduate and graduate students from the University of Illinois at Chicago, Northern Illinois University, the University of Chicago, and other institutions continue to participate in project research, along with a dedicated group of volunteers.

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1990. The Study of Prehistoric Demography in the Northern Rio Grande Valley. Paper presented at the 59th Annual Meeting of the American Association of Physical Anthropologists, Miami, April 3-7, 1990. American Journal of Physical Anthropology 81(2): 210.

1991. (with J. Haas) Search for the Ancient Ones: Pueblo. National Geographic Magazine. October; 84-99.

1992. Regional Exchange Along the Pacific Coast of Costa Rica, During the Late Polychrome Period, A.D. 1200-1550. Journal of Field Archaeology 19: 1-16.

1992. (with J. Haas) Demography and the Proto-Historic Pueblos of the Northern Rio Grande: A.D. 1450-1680. Pp. 21-27 In: B. Vierra (ed.), Late Prehistoric and Early Historic New Mexico. New Mexico Archaeological Council, Albuquerque.

1993. The Architecture of Arroyo Hondo, New Mexico. School of American Research Press. Santa Fe.

1993. (with J. Haas) Stress and Warfare Among the Kayenta Anasazi of the 13th Century A.D. Fieldiana, Anthropology, n.s. 21: 1-211.

1993. Review of Wealth and Hierarchy in the Intermediate Area, edited by Frederick W. Lange. Washington, D.C.: Dumbarton Oaks. Science 260:245-247.

1993. Review of The Ancient Americas: Art From Sacred Landscapes, Chicago, Art Institute of Chicago, including both the publication and the exhibit. Museum Anthropology 17: 80-85.

1994. Reexamining the Black Legend: Contact Period Demography in the Rio Grande Valley of New Mexico. New Mexico Historical Review, July, pp. 263-278.

PAULO E. DE OLIVEIRA

Research Associate, Department of Botany, Field Museum; Visiting Associate Professor, Departamento de Botânica, Universidade Federal do Paraná, Brazil.

B.S., University of São Paulo, Brazil 1980.
M.S., University of Cincinnati, 1985.
Ph.D., The Ohio State University, 1992.

Paleovegetation and Paleoclimates of Brazil.

Research concentrates on the reconstruction of floristic compositions of tropical rainforests and other biomes of Brazil since the time of the last glaciation in the northern hemisphere. In collaboration with the Smithsonian Tropical Research Institute and various Brazilian academic institutions, I am testing ecological, climatological and biogeographical hypotheses concerning the evolution of the Amazonian landscape, the Atlantic rainforests, and the savannas of central Brazil, since the last ice age. Past vegetational changes can be accessed by using pollen grains, diatom frustules, plant pigments, and inorganic cations preserved in ancient lake sediments. This information is then used to infer past climatic change and to interpret former geographical distributions of forest and savanna plant taxa. Recently, I have become interested in determining the extent of human interference in the post-glacial landscape in Brazil. Past human activities are primarily evidenced by the charcoal and lake eutrophication records and agricultural practices provided by the pollen records of the sediments.

Current research projects: the Paleoecology of the Late Quaternary of the Upper Rio Negro, Brazilian Amazon; the role of the Polar Atlantic air mass on the past and present vegetation patterns in southeastern Brazil; the origin of the central Brazil savanna.

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1992. (with M. Steinitz-Kannan) The Diatom Flora (Bacillariophyceae) of the Cuyabeno Faunistic Reserve, Ecuadorian Amazonia. Nova Hedwigia 54,3-4: 515-552.

1992. (with M. B. Bush, D.R. Piperno, P.A. Colinvaux, L.A. Krissek, M.C. Miller and W.E. Rowe) A 14300 year paleoecological profile of a lowland tropical lake in Panama. Ecological Monographs 62(2): 251-275.

1992. (with M. C. Miller and G. Gibeau) Epilithic diatom community response of years of PO_4 fertilization: Kuparuk River, Alaska (68 N Lat.). Hydrobiologia 240: 103-119.

MICHAEL O. DILLON

Curator, Vascular Plants and Head of Phanerogams, Department of Botany, Field Museum; Lecturer, Committee on Evolutionary Biology, University of Chicago.

B.A., University of Northern Iowa, 1969
M.A., University of Northern Iowa, 1972
Ph.D., University of Texas at Austin, 1976

Visiting Professor, Universidad Antenor Orrego, Trujillo, Peru.
Honorary Professor, Universidad Nacional de Cajamarca, Cajamarca, Peru.
Research Associate, Missouri Botanical Garden, St. Louis, MO.
Research Associate, museo de Historia Natural "Javier Prado", Lima, Peru.
Flora Neotropica Commission Member.
Visiting Professor and Curator of Beal-Darlington Herbarium, Michigan State University (1991-1992).

Systematics of Neotropical Asteraceae and Nolanaceae; floras of Chile and Peru; coastal South American ecology and biogeography; floristic inventories, databases and information management.

My research program involves exploration, description, systematic study, and conservation efforts within the New World tropics. Projects involve the study of flowering plants in diverse habitats in the Andean Cordillera, ranging from the hyper-arid deserts of coastal Chile and Peru to mid-elevation mountain forests of northern Peru, and ultimately high-elevation plant communities known as páramos, jalca or puna throughout the Cordillera. Recently, collecting efforts have focused on a large tract of "Selva Alta" a tall forest formation at lower elevations in Amazonian Peru. The objectives of these various studies differ but the botanical information they yield is used to generate floristic inventories of threatened habitats or detailed morphological studies on specific taxonomic groups. This information also allows testing hypotheses of evolutionary relationships and historical biogeography. All projects are conducted in collaboration with local scientific institutions and provide opportunities for interaction and training.

In concert with the data-gathering activities, new methods of information management and dissemination are being pursued. In May 1995, a World Wide Web homepage was launched on the INTERNET and designated ABIS for the Andean Botanical Information System. ABIS is still "under construction" but currently the site provides electronic access to collection information from the floristic and systematic investigations of the flowering plants of Andean South America, including literature, floristic data in a hierarchial browser, and color images of plants and habitats (WWW homepage URL: http://ucjeps.berkeley. edu/abis/abisinfo.html).

* * *

1993. (with M. Muñoz-Schick). A Revision of the Dioecious Genus *Griselinia* (Griseliniaceae), Including a New Species from the Coastal Atacama Desert of Northern Chile. Brittonia 45: 261-274.

1994. (with A. D. Hanson, B. Rathinasabapathi, J. Rivoal, M. Burnet, and D. A. Gage). Osmoprotective compounds in the Plumbaginaceae: A natural experiment in metabolic engineering of stress tolerance. Proceedings of the National Academy of Science 91: 306-310.

1994. (with A. Sagástegui A.). Studies in the Tribe Liabeae (Asteraceae) in Peru: I. A Revision of *Ferreyranthus*. Arnaldoa 2(2): 7-23.

1995. (with A. Sagástegui, I. Sánchez V., S. Llatas Q. and N. Hensold). Floristic Inventory and Biogeographic Analysis of Montane Forests in Northwestern Peru. pp. 251-269, In Biodiversity and Conservation of Neotropical Montane Forests, The New York Botanical Garden, Bronx, NY.

JOHN J. ENGEL

Donald R. Richards Curator, Bryology, Department of Botany, Field Museum.

B.S., University of Wisconsin-Milwaukee, 1965.
M.S., University of Wisconsin-Milwaukee, 1967.
Ph.D., Michigan State University, 1972.

Council Member, International Association of Bryologists.
Chair, Department of Botany, Field Museum, 1988-1993.

Hepatic systematics and phytogeography of the south temperate and subantarctic regions.

The primary objective of my research program is to come to an understanding of hepatic systematics and phytogeography of south temperate and subantarctic regions. These geographic areas present an ideal natural laboratory to investigate biological questions relevant to evolutionary persistence, dispersibility and survival and evolution of plants faced with environmental change. Within that framework I am engaged in detailed, in-depth (monographic) studies of various groups, including *Chiloscyphus* for Australasia, *Telaranea* for Australasia and *Lepidozia* for New Zealand. My research also focuses on the "Hepaticae of the New Zealand," a three-volume work in collaboration with Dr. R. M. Schuster, a Research Associate of Field Museum. My program includes elements of biogeography, ecology, morphology and phylogeny. I am also investigating problems involving functional morphology of hepatic structures and I am doing so in a broad evolutionary context.

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1980. A monograph of *Clasmatocolea* (Hepaticae). Fieldiana: Botany, n.s. 3: 1-229.

1985. (with R. M. Schuster) Austral Hepaticae V (2). Temperate and subantarctic Schistochilaceae of Australasia. Journal of the Hattori Botanical Laboratory 58: 255-539.

1990. Falkland Island (Islas Malvinas) Hepaticae and Anthocerotae: A taxonomic and phytogeographic study. Fieldiana: Botany, n.s. 25: 1-209.

1990. Studies on Geocalycaceae. I. The taxonomic position of *Chiloscyphus amplectens* (Mitt.) Engel and Schust. together with refinements in *Heteroscyphus* Schiffn. Journal Hattori Botanical Laboratory 68: 303-315.

1991. Studies on Geocalycaceae (Hepaticae). II. *Stolonivector*, a new genus from New Zealand. Journal of the Hattori Botanical Laboratory 69: 79-86.

1991. Studies on Geocalycaceae (Hepaticae). IV. *Lamellocolea*, a new genus of Leptoscyphoideae from New Zealand. Journal of the Hattori Botanical Laboratory 70: 63-78.

1992. Studies on Geocalycaceae (Hepaticae). VIII. A revision of *Chiloscyphus* subg. *Notholophocolea* (Schust.) Engel and Schust. Journal Hattori Botanical Laboratory 72: 105-115.

1993. Index Hepaticarum Supplementum: 1986—1987. Taxon 42: 373-391

1994. (with R. M. Schuster) Studies of New Zealand Hepaticae. 7. The status of *Steereomitrium*. Bryologist 97: 63-66.

(with G. Merrill) Studies of New Zealand Hepaticae. 8-13. *Bazzania* and *Acromastigum*. Bryologist 97: 313-320, f. 1-3.

JOHN J. FLYNN

MacArthur Curator, Fossil Mammals and Chair, Department of Geology, Field Museum; Associate Chair and Lecturer, Committee on Evolutionary Biology, University of Chicago.

B.A., Geology and Geophysics, Yale University, 1977.
M.A, Geological Sciences, Columbia University, 1979.
Ph.D., Geological Sciences, Columbia University, 1983.

Alfred Sherwood Romer Prize (4th Annual), Society of Vertebrate Paleontology, 1982.
Secretary, Society of Vertebrate Paleontology, 1993—present.
Associate Editor, Journal of Vertebrate Paleontology, 1989-1992.
Leader of numerous field expeditions supported by the NSF, NASA, National Geographic Society, etc.

Mammalian systematics and evolution/geochronology and plate tectonics/biogeography.

Research emphasizes a multidisciplinary approach to geologic and biologic problem-solving, incorporating my interests in two different, but related geologic specialties: mammalian paleontology and paleomagnetism. Recent field expeditions (in the United States and South America) and laboratory projects integrating biostratigraphy, paleomagnetic stratigraphy, and radioisotopic dating have included: i) refinement of the global Cenozoic geologic time scale and the South American Cenozoic terrestrial chronology; ii) chronologic and faunal studies of 50 million year old mammal faunas from southwestern Wyoming; iii) new discoveries of fossil mammal faunas in South America, providing a better understanding of South American mammal faunal evolution and biogeography; and iv) constraining the tectonic and uplift history of the Andean Mountain belts. I established a Paleomagnetism Lab with a magnetically-shielded chamber at The Field Museum that is available for staff and student research. Another aspect of my research focuses the anatomy and evolutionary relationships of the mammalian order Carnivora, and its extinct relatives. A new project in collaboration with post-doctoral fellow Michael Nedbal involves DNA sequencing to analyze the higher-level evolutionary relationships and rates of evolution of Carnivora, integrating paleontologic and molecular data.

I am interested in students and collaborators with interests in: i) integration of paleontologic and geologic techniques, particularly those emphasizing patterns of paleobiologic change through space and geologic time; or ii) any aspect of mammalian phylogeny. The Field Museum has excellent Recent and fossil mammal collections, and geologic, biochemical (DNA sequencing) and morphometric/image analysis laboratories for use by students and staff.

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1986. Correlation and geochronology of Middle Eocene strata from the western United States. Palaeogeography Palaeoecology, Palaeoclimatology 55: 335-406.

1993. (with A. R. Wyss) A phylogenetic analysis and definition of the Carnivora, Pp. 32-52. In: F. Szalay, M. Novacek, M. McKenna (eds.), Mammal Phylogeny: Placentals, Springer-Verlag.

1993. (with A. R. Wyss, M. A. Norell, C. C. Swisher III, R. Charrier, M. J. Novacek, and M. C. McKenna) "South America's earliest rodent and recognition of a new interval of mammalian evolution." Nature 365: 434-437.

1995. (with A. R. Wyss, R. Charrier and C. C. Swisher III) An Early Miocene anthropoid skull from the Chilean Andes. Nature 373: 603-607.

1995. (with C. C. Swisher III) Chronology of the Cenozoic South American Land Mammal Ages. Pp. 317-333. In: W. A. Berggren, D. V. Kent and J. Hardenbol (eds.), Geochronology, Time-Scales, and Global Stratigraphic Correlation, SEPM (Soc. for Sedimentary Geology) Spec. Publ. No. 54.

JACK FOODEN

Research Associate, Mammals, Department of Zoology, Field Museum; Emeritus Professor of Zoology, Department of Biological Sciences, Chicago State University.

M.A., Sociology, University of Chicago, 1951.
M.Ed., Science Education, Chicago Teachers College, 1956.
Ph.D., Zoology, University of Chicago, 1960.

Consulting Editor, American Journal of Primatology.
Editorial Board, International Journal of Primatology.

Primate systematics, particularly Asian catarrhines.

My major research effort has been devoted to systematic review of the genus *Macaca*, a widely distributed group of Old World monkeys. Subjects investigated include geographic variation of external, cranial, and molecular characters; natural history; and paleontology. Field work has been conducted in collaboration with local zoologists in China, India, Indonesia, and Thailand. To date, fifteen of the nineteen recognized species of macaques have been monographed.

* * *

1985. (with Quan Guoqiang, Wang Zongren and Wang Yingxiang) The stumptail macaques of China. American Journal of Primatology 8: 11-30.

1986. Taxonomy and evolution of the sinica group of macaques: 5. Overview of natural history. Fieldiana: Zoology, n.s. 29: 1-22.

1987. (with Quan Guoqiang and Luo Yining) Gibbon distribution in China. Acta Theriologica Sinica 7: 161-167.

1988. Taxonomy and evolution of the sinica group of macaques: 6. Interspecific comparisons and synthesis. Fieldiana: Zoology, n.s. 45: 1-44.

1989. (with S. Lanyon) Blood-protein allele frequencies and phylogenetic relationships in *Macaca:* a review. American Journal of Primatology 17: 209-241.

1990. The bear macaque, *Macaca arctoides:* a systematic review. Journal of Human Evolution 19: 607-686.

1991. Systematic review of Philippine macaques (Primates, Cercopithecidae: *Macaca fascicularis* subspp.). Fieldiana: Zoology, n.s. 64: 1-44.

1993. (with G. H. Albrecht) Latitudinal and insular variation of skull size in crab-eating macaques (Primates, Cercopithecidae: *Macaca fascicularis*). American Journal of Physical Anthropology 92: 521-538.

1994. Malaria in macaques. International Journal of Primatology, 15: 573-596.

ROBIN B. FOSTER

Conservation Ecologist (Botany), Environmental and Conservation Programs, Field Museum; Research Biologist, Smithsonian Tropical Research Institute; Conservation Botanist, Research Dept., Selby Botanical Gardens.

A.B., Biology, Dartmouth College, 1966.
Ph.D., Botany, Duke University, 1974

Senior Scientist Associate, Marie Selby Botanical Gardens, 1994-present.
Commission for Flora Neotropica, 1994-present.
Scientific Board, International Center for Tropical Ecology, 1991-present.
Investigador Asociado, Museo de Historia Natural, Lima, Peru, 1990-present.
Senior Ecologist, Conservation International, 1987-1994.
Research Associate, Missouri Botanical Garden, 1984-present.
Executive Committee, International Society for Tropical Ecology, 1976.
Trustee and Research Associate, Institute for Botanical Exploration, 1974- present.
Board of Directors, Organization for Tropical Studies, 1973-1980.
Assistant Professor of Biology, University of Chicago, 1972-1980.

Conservation biology; Tropical forest ecology and geography; Plant community composition and dynamics; Floristics; Reproductive biology of plants; Environmental education.

At a small scale, I am asking what determines tropical plant community composition, what makes species rare or common, and how and why things change over a long period. I have focused mainly on the Rio Manu in the upper Amazon of Peru, and Barro Colorado Island, Panama -- especially a 50-hectare plot on which my colleagues and I have mapped and measured a quarter-million woody plants and continue to monitor their growth and population changes. We are finding there is a remarkable variety in species spatial-distribution. More important, in both sites the first few years of colonization and the role of animals are crucial in determining the local fate of the forest for the next several hundred years.

At the other extreme, I try to map the large-scale physiographic and floristic context of the small-scale research by diffuse sampling. The objectives are to interpret regional or continental-scale patterns of vegetation and floras and to select priority areas for conservation. This requires rapid sampling of huge areas and rapid identification of plants. The lack of tools and resources for identifying plants in the tropics is a bottle-neck for all researchers and students, and a barrier to public interest. It has provoked me to find new ways to do something about the problem, and to take advantage of the vast resource of tropical collections in the herbarium of Field Museum.

* * *

1980. Heterogeneity and disturbance in tropical vegetation. Pages 75-92 in: Soule, M.E. and B.A. Wilcox (eds.), Conservation Biology: An Evolutionary-Ecological Perspective. Sinauer Press.

1982. The seasonal rhythm of fruit fall on Barro Colorado Island. Pages 151-172 in: Leigh, E.G., A.S. Rand, and D.M. Windsor (eds.), The Ecology of a Tropical Forest. Smithsonian Press.

1986. (with S.P.Hubbell) Commonness and rarity in a neotropical forest: implications for tropical tree conservation. Pages 205-231 in: Soulé, M. (ed.) Conservation Biology: Science of Scarcity and Diversity. Sinauer Press.

1986. (with J. Arce B., and T. Wachter) Dispersal and the sequential communities in Amazonian Peru floodplain. Pages 357-370 in: Estrada, A. and T.H. Fleming (eds.) Frugivores and Seed Dispersal. W. Junk Publishers.

1992. (with S.P.Hubbell) Short-term dynamics of a neotropical forest: why ecological research matters to tropical conservation and management. Oikos 63:48-61.

STEVEN M. GOODMAN

Field Biologist, Mammals, Department of Zoology, Field Museum;Visiting Professor, Université d'Antananarivo, Madagascar,coordinator biological inventories and Ecology Training Programme,World Wildlife Fund, Madagascar.

B.S., Biology, University of Michigan, 1977.

Conservation Biology/Tropical Biology/Avian and Mammalian Community Ecology/Taphonomy/Ethnobotany/Egyptology.

The fauna of Madagascar and the Eastern Arc Mountains in Tanzania have extraordinarily high numbers of endemic species, many of which are threatened with extinction, primarily as a result of human-mediated habitat destruction and disturbance. One aspect of constructing detailed conservation plans for these biota are faunal surveys that document the current flora and fauna in various threatened sites.

Although it is well documented that a wave of extinction affected large-bodied animals about the time that humans colonized the Madagascar, the knowledge of the island's fauna in the recent past is woefully incomplete. To assess the influence of human activity on the fauna in the recent past, another research program is an investigation of sub-fossil vertebrate deposits. Training of, and collaboration with, Malagasy students is a major component of these programs.

Research on the ethnobotany of cultures in North Africa and south-west Asia has been conducted in recent years. Important questions in understanding the evolution of plant resource utilization are whether or not these cultures use the same basic floristic components in similar manners, and if so, whether this is because of information exchange between these cultures, parallel experimentation, or based on chance. Documentation of the uses of various medicinal plants, before many of these practices disappear, is crucial to answering these questions.

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1988. (with C. Glynn) Comparative rates of natural osteological disorders in a collection of Paraguayan birds. Journal of Zoology 214: 167-177.

1988. (with J. J. Hobbs) The ethnobotany of the Egyptian Eastern Desert : A comparison of common plant usage between two culturally distinct Bedouin groups. The Journal of Ethnopharmacology 23: 73-89.

1989. The Birds of Egypt. (co-edited with Peter L. Meininger). Oxford: Oxford University Press.

1990. (with P. C. Gonzales) The birds of Mt. Isarog National Park, Southern Luzon, Philippines, with particular reference to altitudinal distribution. Fieldiana, Zoology, n. s. 60.

1992. (with A. Ghafoor). The ethnobotany of Southern Balochistan, with particular reference to medicinal plants. Fieldiana, Botany n.s. 31.

1993. (with F. Ravoavy). Identification of bird subfossils from cave deposits at Anjohibe, Madagascar, with a description of a new giant Coua (Cuculidae: Couinae). Proceedings of the Biological Society of Washington 106: 24-33.

1993. A reconnaissance of Isle Sainte Marie, Madagascar: the status of the forest, avifauna, lemurs and fruit bats. Biological Conservation 65:205-212.

1994. The enigma of anti-predator behavior in lemurs. Evidence of a large extinct eagle on Madagascar. International Journal of Primatology 15:97-102.

1994. (with D. Halleux) The rediscovery of the Madagascar Red Owl Tyto soumagnei (Grandidier, 1878) in north-eastern Madagascar. Bird Conservation International 4: 263-277.

1995. The spread of Rattus on Madagascar: The dilemma of protecting the endemic rodent fauna. Conservation Biology 9:450-453.

LANCE GRANDE

Curator, Fossil Fishes, Department of Geology, Field Museum; Lecturer, Committee on Evolutionary Biology and Biological Sciences Collegiate Division, University of Chicago; Adjunct Professor of Biology, University of Massachusetts; Adjunct Professor of Biology, University of Illinois-Chicago.

B.S., Geology, University of Minnesota, 1976.
M.S., Geology and Zoology, University of Minnesota, 1979.
Ph.D., Evolutionary Biology, City University of New York/American Museum, 1983.

Research Associate, American Museum of Natural History.
Editorial Board, Revista.
Associate Editor, Journal of Vertebrate Paleontology, 1986-1988.
Member, Program Committee and Romer Prize Committee, Society of Vertebrate Paleontology.

Phylogenetic interrelationships/historical biogeography of fossil and living actinopterygian fishes. The relationship between the evolution of organisms, and the evolution of the surface of the Earth.

In the most general sense, my research program uses studies of comparative osteology and ontogeny in fossil and living fishes to investigate questions about evolution and historical biogeography. My approach is an interdisciplinary one. I am interested in both fossil and living fishes, so I selected taxonomic groups for study that have extant species together with well-preserved fossil species. Groups of particular interest to me are Siluriformes (catfishes), Acipenseriformes (sturgeons and paddlefishes), Clupeomorpha (herring and herring-like fishes), Osteoglossomorpha (bony-tongues) and several other lower teleostean groups.

I am also pursuing studies on ontogeny in the fossil record and late ontogeny in extant species. The different types of intraspecific morphological variation (i.e. ontogenetic vs. non-ontogenetic) and its effect on phylogenetic reconstruction is also part of my recent research program, as is the use of paleontology in systematics and historical biogeography.

I would be particularly pleased to supervise students interested in doing phylogenetic work on some groups of fossil and living fishes. In particular, I would like to support interdisciplinary thesis projects involving detailed osteological analyses that include studies of ontogeny, historical biogeography and/or related topics of general significance. Field Museum has the best fossil fish collection in North America and an excellent collection of Recent fishes.

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1985. The use of paleontology in systematics and biogeography, and a time control refinement for historical biogeography. Paleobiology 11(2): 1-11.

1985. (with G. Nelson) Interrelationships of fossil and Recent anchovies (Teleostei: Engrauloidea) and a description of a new species from the Miocene of Cyprus. American Museum Novitates 2826: 1-16.

1986. (with J. T. Eastman) A review of the Antarctic ichthyofaunas, in light of new fossil discoveries. Palaeontology 29(1):113-137.

1991. (with W. Bemis) Osteology and phylogenetic relationships of fossil and Recent paddlefishes (Polyodontidae) with comments on the interrelationships of Acipenseriformes. Society of Vertebrate Paleontology Memoir 1 (supplement to Vol. II, no. 1, Journal of Vertebrate Paleontology 1—121).

1992. (with W. Bemis) Early development of the actinopterygian head. General observations and comments on staging of the paddlefish *Polyodon spathula*. Journal of Morphology 213: 47-83.

1994 (with O. Reippel) Interpreting the Hierarchy of Nature: From Systematic Patterns to Evolutionary Process Theories. Academic Press, 297 pp.

ANNA GRAYBEAL

Assistant Curator, Amphibians and Reptiles, Department of Zoology, Field Museum

B.A., Harvard University, 1987.
Ph.D., University of California at Berkeley, 1995.

Stoye Award, American Society of Ichthyologists and Herpetologists, 1992 and 1993.
Ernst Mayr Award, Society of Systematic Biologists, 1994.
Editorial Board, Systematic Biology, 1995 - present

Phylogenetic systematics and evolution of bufonid frogs/systematic methods and theory/speciation/species concepts/character evolution/biogeography

My research interests focus on the evolution of diversity, both macroevolutionary (patterns of character evolution, biogeography) and microevolutionary (population differentiation and speciation). I address these topics using the large frog family Bufonidae ("True Toads") because these organisms display interesting patterns of similarity and differentiation, hybridization, and geographical distribution. My principle source of data is molecular (primarily DNA sequences), though I also work with morphological characters. While the main goal is to use genetic sequences to determine phylogenetic relationships among the toad species and subsequently interpret patterns of character evolution and biogeographical radiation, I maintain a strong interest and curiosity regarding the various aspects of this analytical process, including how to achieve and evaluate support for particular relationships, how to evaluate the phylogenetic utility of genetic sequences, etc., and enjoy pursuing side projects on these topics. My microevolutionary research is beginning with a study of speciation in several species groups of North American toads. I am obtaining DNA sequences from various genes and using coalescent methods to explore different microevolutionary processes that may affect or be symptomatic of speciation. These data will also be used to provide empirical insight into current debates over species concepts.

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1989. (with J. J. Rosowski, D. Ketten, and A.W. Crompton) Inner ear structure in *Morganucodon*, an early Jurassic mammal. Zoological Journal of the Linnean Society 96: 107-117.

1992. (with K. de Queiroz) Inguinal amplexus in *Bufo fastidiosus*, with comments on the systematics of bufonid frogs. Journal of Herpetology 26: 84-87.

1993. The phylogenetic utility of cytochrome b: lessons from bufonid frogs. Molecular Phylogenetics and Evolution 2: 256-269.

1994. Review of "The Unity of Evolutionary Biology: Proceedings of the Fourth International Congress of Systematic and Evolutionary Biology," Volumes 1 and 2, edited by Elizabeth C. Dudley. Systematic Biology 43: 136-139.

1994. Evaluating the phylogenetic utility of genes: a search for genes informative about deep divergences among vertebrates. Systematic Biology 43: 174-193.

1995. (with D. C. Cannatella) A new taxon of Bufonidae from Peru, with descriptions of two new species and a review of the phylogenetic status of supraspecific bufonid taxa. Herpetologica 51: 105-131.

1995. Naming species. Systematic Biology 44: 237-250.

JONATHAN HAAS

MacArthur Curator of North American Anthropology, Department of Anthropology, Field Museum; External Professor, Santa Fe Institute; Research Associate, Department of Anthropology, University of Chicago; Adjunct Professor, Department of Anthropology, University of Illinois at Chicago.

B.A. Anthropology, University of Arizona, 1970.
Ph.D. Anthropology, Columbia University, 1979

Review Committee for the Native American Graves Protection and Repatriation Act, 1992-present.
Working group on "Human Societies as Complex Adaptive Systems" Santa Fe Institute, 1988-present.
Task Force on Anthropology and the Environment, Chair, 1991, Steering Committee Member, 1992-1995.
Advisory Board, Chi9cago Area Fulbright Scholar Program. Council for International Exchange of Scholars. 1990-1994.
Committee on Museums and Native American Collaboration, American Association of Museums, 1991-present.
Series Editor, School of American Research Advanced Seminar Series, Cambridge University Press, 1986-1989.

Evolution of political systems with a focus on the archaeology of the southwestern United States.

My time is fairly evenly divided between project related to research, collections, and public learning. My current research in the Southwest is being conducted in conjuction with my colleague, Dr. Winifred Creamer, Associate Professor of Anthropology at Northern Illinois University, and Adjunct Associate Curator at The Field Museum. Together, we are looking at the effects of European contact and colonialism on the Pueblo peoples of northern New Mexico in the 16th and 17th centuries A.D. The initial focus of the project is on possible changes in the size and distribution of the population of the region during the time just before and after the arrival of the Spanish in 1540. By examining archaeological and ethnohistorical records of the area we are gaining new insights into the effects of Spanish disease and regional warfare on the Pueblo peoples.

I am also working with Public Programs on an extensive reorganization of the current exhibits in the North American Indian halls. The exhibits are being consolidated and rearranged to be as effective as possible. In the collections area, I have started a long term project to inventory and catalog the large collections made by long-time anthropology curator Paul Martin in the Southwest. I am also working with a team to plan for a reorganization of the anthropology collections to get objects into more appropriate storage facilities and to make the most efficient use of existing space. Repatriation continues to occupy a great deal of my time. We have just completed a comprehensive inventory of our Native American human remains and are working with many different Indian groups on the care and treatment of important cultural objects and human remains.

* * *

1990. The Anthropology of War, ed. Cambridge University Press.

1993. (with W. Creamer) Stress and Warfare Among the Kayenta Anasazi of the 13th Century A.D. Fieldiana: Anthropology, n.s. 21:1-211.

1993. "Repatriation in a Global Context for Natural History Museums." In Current Issues, Initiatives, and Future Directions for the Preservation and Conservation of Natural History Collections, Vol. 3, edited by Carolyn Rose, Stephen Williams and Julio Gisbert, pp.71-81. Proceedings of the International Symposium and First World Congress on the Preservation and Conservation of Natural History Collections, Madrid.

1994 (with David Wilcox)."The Scream of the Butterfly: Competition and Conflict in the Prehistoric Southwest." Pp. 211-238, in Themes in Southwestern Prehistory. edited by George Gumerman. School of American Research Press, Santa Fe.

1995. Standards for Data Collection from Human Skeletal Remains, organizer and contributor. Volume edited by Jane Buikstra and Douglas Ubelaker. Arkansas Archeological Survey Research Series 44:1-206.

SHANNON J. HACKETT

Assistant Curator and Head, Birds, Department of Zoology, Field Museum.

B.S., University of Victoria, Canada, 1983.
M.S., Louisiana State University, 1987.
Ph.D., Louisiana State University, 1992.

Molecular systematics and biogeography of birds/analysis of molecular data.

My research focuses on determining patterns of phylogeny and relating those patterns to the biogeographic history of southern Central and South America. Despite the widespread use of bird distributional data to support the refugia hypothesis of diversification in the Neotropics, there are surprisingly few phylogenetic studies of Neotropical birds that can be used to assess various causal mechanisms for the high species diversity in Central and South America. I use mainly DNA sequences to derive phylogenies for various groups of Neotropical birds. Along with the work of other scientists, my research casts doubt on the late Pleistocene as the major time period of diversification of Neotropical birds; it appears that much of the diversification is much older than the last glacial period.

From a phylogenetic methodological perspective, I am also interested in the information content of different kinds of data (molecular, morphological, behavioral, ecological) for phylogeny reconstruction. I believe that there has been too little emphasis placed on the design of molecular studies (choice of taxa to be analyzed) and analyses of the information content of DNA sequence data. For example, homoplasy is abundant in many molecular sequence data sets, and the amount of saturation of sites (i.e., at third positions of codons) can result in positively misleading phylogenetic hypotheses. In my research, I am exploring ways of identifying saturated partitions of data and down-weighting those partitions.

One of my current research projects is a molecular phylogenetic analysis of a small family of Neotropical birds, the Pipridae. I am assessing the degree to which different data sets compiled for this family agree/disagree in their estimations of phylogeny and why. I am gathering DNA sequence data from mitochondrial genes and am comparing these data to previously published morphological (syringeal data) and behavioral data and to a data set based on plumages that I am gathering. Another of my research projects focuses at a lower taxonomic level to compare patterns of phylogeny, character evolution (molecular, vocal, morphological, plumage), and biogeography in a series of co-distributed widespread Amazonian bird species.

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1988. (with R. M. Zink) Biogeographic patterns in the avifauna of North America. Proceedings of the XIX International Ornithological Congress, Ottawa, Canada.

1989. Effects of varied electrophoretic conditions on detection of evolutionary patterns in the Laridae. Condor 91: 73-90.

1990. (with K. V. Rosenberg) Evolution of Amazonian antwrens: Comparison of genetic and phenotypic differentiation. Auk 107: 473-489.

1992. (with R. T. Chesser) Mammalian diversity in South America: A response to Mares. Science 256: 1502-1505.

1993. Phylogenetic and biogeographic relationships in the Neotropical genus *Gymnopithys* (Formicariidae). Wilson Bulletin 105: 301-315.

1995. (with C. S. Griffiths, J. M. Bates, and N. K. Klein) A Commentary on the use of sequence data for phylogeny reconstruction. Molecular Phylogenetics and Evolution 4: 350-353.

1995. Molecular systematics and zoogeography of flowerpiercers in the *Diglossa baritula* complex. Auk 112: 156-170.

LAWRENCE R. HEANEY

Associate Curator and Head, Mammals, Department of Zoology, Field Museum; Lecturer, Committee on Evolutionary Biology, University of Chicago.

B.S., Biology, University of Minnesota, 1971.
M.A., Systematics and Ecology, University of Kansas, 1975.
Ph.D., Systematics and Ecology, University of Kansas, 1979.

Research Fellow, Smithsonian Institution, 1986-1988.
Research Associate, Smithsonian Institution, 1988-present.
Research Associate, American Museum of Natural History, 1991-present.
Research Associate, Utah Museum of Natural History, 1994-present.
Honorary Curator, Department of Zoology, Philippine National Museum, 1990-present.
Science Advisor, Center for Tropical Conservation Studies, Silliman University, Philippines, 1992-present.

Mammalian evolution and ecology/evolutionary biogeography/origin and maintenance of patterns of biological diversity/conservation biology/tropical biology.

In spite of the long-term interest of biologists in the dynamics of the processes that influence patterns of biological diversity, a comprehensive understanding has yet to emerge. My current research program focuses on the ecology and evolution of mammals on the islands of Southeast Asia, especially the Philippines, as a natural laboratory where the influence of area, habitat diversity, degree of isolation, and geological histories may be investigated. Variation in these factors allows direct investigation of patterns of extinction, colonization, and speciation in a remarkably diverse fauna. Studies include analysis of morphological, genetic, and ecological diversification, evolution of life history traits, reproductive ecology, and plant-animal interactions. Rapid destruction of natural habitats and extinction of native species has led me to integrate formal ecological and evolutionary studies with research and consulting activites on the impact of deforestation. I am increasingly active in providing advanced training in conservation biology to scientists from the tropics.

Much of my work includes participation by graduate students from both within and outside of the United States. Past students have studied reproductive ecology of bats, seed dispersal systems, tree squirrel population biology, mammalian paleoecology, evolution and functional morphology of horned mammals, population genetics of mammals in island ecosystems, and population biology of tropical birds.

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1984. Mammalian species richness on islands on the Sunda Shelf, Southeast Asia. Oecologia 61:11-17.

1984. Climatic influences on life history tactics and behavior of North American tree squirrels. Pp. 43-78. In: The Biology of Ground Dwelling Squirrels, J.O. Murie and J.R. Michener (eds.). University of Nebraska Press. 459 pp.

1986. L.R. Heaney and B. D. Patterson, eds. Island Biogeography of Mammals. Academic Press, London. 271 pp. (initially produced as a special issue of the Biological Journal of the Linnean Society).

1989. (with P. D. Heideman, E. A. Rickart, R. B. Utzurrum and J. S. H. Klompen) Elevational zonation of mammals in the central Philippines. Journal of Tropical Ecology 5: 259-280.

1993. (with A. T. Peterson) Genetic differentiation in Philippine bats of the genera *Cyrnopteris* and *Haplonycteris*. Biological Journal of the Linnean Society 49: 203-218.

1993. Biodiversity patterns and conservation of mammals in the Philippines. Pp. 261-274. In "Philippine vertebrates: symposium on their preservation and conservation" (L. R. Heaney, W. S. Gruezo, C. C. Custodio, and E. A. Rickart, eds.). Asia Life Sciences, 2:101-304.

PATRICK S. HERENDEEN

Adjunct Assistant Curator, Fossil Plants, Department of Geology, Field Museum.

B.S. California State University, Long Beach. 1982.
M.S. Michigan State University, East Lansing, Michigan, 1985.
Ph.D. Indiana University, Bloomington, Indiana, 1990.

Visiting Professor, Indiana University, Department of Biology, June-August, 1990.
Research Associate, Department of Botany, The Field Museum, Chicago, Il. 1993- present.
Postdoctoral Research Fellow, Swedish Museum of Natural History. August 1990-1991.
Postdoctoral Research Associate, Bailey Hortorium, Cornell University. Sept. 1991- March 1993.

Systematics and paleobotany of flowering plants.

My studies address the evolutionary history of plants and in particular the history of large complex groups such as the legumes and laurels, as well as the angiosperms as a whole. My work has focused on understanding systematic and biogeographic relationships within families, and on structural evolution in early angiosperms. Recent work has been directed at two research projects: paleobotany and systematics of the legume family, and the Cretaceous fossil record of flowering plants (angiosperms). My current major legume project is a combined paleobotanical and neobotanical study of the diverse tropical subfamily Caesalpinioideae. This group has a fairly rich fossil record and it will be important to incorporate as many extinct taxa as possible in the cladistic analyses. I have also been pursuing studies of the Cretaceous fossil record of flowering plants. One focus of this research has been a study of Cretaceous fossil floras from the southeastern Atlantic Coastal Plain. I am also involved in a study of structural evolution in the wood of early angiosperms. This project is assessing patterns of evolution in the secondary xylem of Cretaceous angiosperms. Data from this study are facilitating an evaluation of a number of traditional hypotheses of evolutionary patterns in angiosperm wood, particularly evolution of vessel and ray structure.

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1992. (with D. L. Dilcher) (eds.). Advances in Legume Systematics, part 4. The Fossil Record. Royal Botanic Gardens, Kew.

1993. (with W. L. Crepet and K. C. Nixon) *Chloranthus*-like stamens from the Upper Cretaceous of New Jersey. American Journal of Botany 80: 865-871.

1994. (with P. R. Crane and S. Ash) Vegetation of the dinosaur world. Dino Fest: proceedings of a conference for the general public. G. D. Rosenberg and D. L. Wolberg, editors. Paleotol. Soc. Spec. Publ. 7, Pp. 347-364. Univ. Tennessee Press, Knoxville.

1994. (with W. L. Crepet and K. C. Nixon) Fossil flowers and pollen of Lauraceae from the Upper Cretaceous of New Jersey. Plant Systematics and Evolution 189: 29-40.

1995. (with P. R. Crane, and A. N. Drinnan) Fagaceous flowers, fruits and cupules from the Campanian (Late Cretaceous) of central Georgia, USA. International Journal of Plant Sciences.

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1995. (with P. R. Crane) The fossil history of the monocotyledons. Monocotyledons: Systematics and Evolution. P. J. Rudall, P. Cribb, D. F. Cutler, and C. J. Humphries, Editors. Royal Botanic Gardens, Kew.

CHUIMEI HO

Adjunct Curator, Asian Archaeology and Ethnology, Department of Anthropology, Field Museum; Adjunct Research Associate, Center for Southeast Asian Studies, Northern Illinois University; Research Associate, Center of Asian Studies, University of Hong Kong; Guest Curator, East Asian Anthropology, Denver Museum of Natural History.

B.A., University of Hong Kong, 1977.
M.Phil., University of London, 1980.
Ph.D., University of London, 1984.

Collection Committee, Museum of Art, Beloit College, Wisconsin, 1993-95.
Executive Committee, Chinese Ancient Ceramic Society, China, 1993-95.
Vice-Chairman, Committee for Friends of the Museum, Dehua Ceramic Museum, China, 1993-95.
Editor, ACRO Update, an international quarterly newsletter for the study of Asian ceramics, Chicago, 1993-95

Early communications between China and other East Asian and Southeast Asian countries, particularly through the study of archaeological ceramics.

The study of interregional relationships among East and Southeast Asian countries through archaeological materials of the last two thousand years has filled in many details about those societies. I have initiated and/or participated in a number of field projects studying ancient ceramic industrial sites in China, Korea, Japan and Thailand. I have also worked at early seaport sites in Thailand and Indonesia, where imported ceramics were traded and used. The results have helped to explain the evolution of local economies and interregional trade. I have also done research on ceramic ethnoarchaeology aimed at understanding technology and industrial organization in less developed communities of the present day.

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1988. Minnan Blue and White, An Archaeological Survey of Ancient Kiln Sites in South Fujian. British Archaeological Research Centre, Oxford. 230 pp.

1990. Ancient Ceramic Kiln Technology in Asia. Centre of Asian Studies, University of Hong Kong.

1991. Chinese Presence in Southern Thailand Before 1600 AD From Archaeological Evidence. Pp. 289-307, In: China and the Maritime Silk Route. Quanzhou International Seminar on China and the Maritime Routes of the Silk Roads Organization Committee, Fujian.

1992. Trade and Manufacture: Guangdong Ceramics in the Late Tang Period. Journal of Trade Ceramics 12:159-184.

1994. Ceramic Trade in Asia between 1602 and 1683 AD. Pp.35-70, In: A. J. H. Latham and Heita Kawakatsu (eds.), Japanese Industrialization and the Asian Economy, London.

1995 ["1994"] New Light on Chinese Yue and Longquan Wares. Hong Kong: Centre of Asian Studies, University of Hong Kong.

SABINE M. HUHNDORF

Research Associate, Mycology, Department of Botany, Field Museum

B.S., Biology, University of Illinois, Chicago, 1984
M.S., Plant Pathology, University of Illinois, Urbana-Champaign, 1987
Ph.D., Plant Pathology, University of Illinois, Urbana-Champaign, 1990

Assistant Curator, Mycology, The New York Botanical Garden, 1991-1993.
National Research Council Associate, USDA-FS, Forest Products Lab, Madison, WI, 1995.
Martin-Baker Research Award, Mycological Society of America, 1994.
Participant in expeditions to Argentina, Brazil, Cuba, French Guiana, Puerto Rico, Venezuela,

Systematics, biogeography and floristics of Ascomycetes

My research on fungi focuses on Ascomycetes, specifically Loculoascomycetes and Pyrenomycetes, organisms which are plant pathogens and agents of decomposition. My research has floristic and monographic components. Recent monographic studies include works on the cosmopolitan genus Leptosphaeria and the tropical genera, Xenolophium and Pseudotrichia. I am currently working on worldwide monographs of Lasiosphaeria and Chaetosphaeria, two genera that occur on woody hosts. Additional studies include treatments of the pantropical genus Astrosphaeriella that occurs on palms and bamboos and on Trematosphaeria found on woody hosts. These systematic studies lead to improved classification and a better understanding of generic relationships in these groups and test theories of speciation and biogeography. My work involves the microscopic examination and assessment of herbarium specimens along with laboratory in vitro culture studies of fresh specimens to determine growth and reproductive characteristics.

My floristic work is focused in the West Indies and in French Guiana. In general, Ascomycetes are not well-known and have not been widely collected from many tropical habitats. Areas like the tropical, lowland, rainforest in Saül, French Guiana and the Caribbean National Forest in Puerto Rico offer the possibility to survey and inventory the Ascomycete mycota and ask questions about biology, ecology, distribution and host specificity. These projects involve an active field work program as well as laboratory studies. These surveys will serve as models for assessing Ascomycete biodiversity in other tropical forests and ultimately, the information on fungal biodiversity will lead to a manual for identifying tropical Ascomycetes.

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1992. Neotropical Ascomycetes 1. Valsonectria cinnamomi in artificial culture. Mycologia 84:642-649.

1992. Neotropical Ascomycetes 2. Hypsostroma, a new genus from the Dominican Republic and Venezuela. Mycologia 84:750-758.

1992. The systematics of Leptosphaeria species found on the Rosaceae. Illinois Natural History Survey Bulletin 34(5):479-534.

1992. Studies in Leptosphaeria. Transfer of Leptosphaeria opuntiae to Montagnula (Ascomycetes). Brittonia 44:208-212.

1993. Neotropical Ascomycetes 3. Reinstatement of the genus Xenolophium and two new species from French Guiana. Mycologia 85:490-502.

1994. Neotropical Ascomycetes 4. Pseudotrichia guatopoensis, a new species from Venezuela, with a key to species in the genus. Mycologia 86:134-137.

1994. Neotropical Ascomycetes 5. Hypsostromataceae, a new family of Loculoascomycetes and Manglicola samuelsii, a new species from Guyana. Mycologia 86:266-269.

ROBERT F. INGER

Curator Emeritus, Amphibians and Reptiles, Department of Zoology, Field Museum; Lecturer, Committee on Evolutionary Biology, University of Chicago.

B.S., University of Chicago, 1942.
Ph.D., University of Chicago, 1954.

Editorial Board, Zoological Research (Kunming).
Distinguished Scientist, The Field Museum.
Honorary Curator of Reptiles, Sarawak Museum.

Community ecology/tropical amphibians and reptiles/systematics of anuran amphibians.

Although much has been written about the organization and structure of tropical communities of vertebrates, almost nothing is known about variation of those communities within a region over time. I am studying variation in the structure of communities of amphibians in Bornean forests over time (one to twenty years) and space. This program involves work both in the field and in the museum laboratory and analysis of species diversity at the local and regional levels, relative abundance of species, movements of individuals, annual patterns of reproduction, and partitioning of spatial resources by adults and larvae.

My systematics research concentrates on phylogenetic relations of several families of anurans that form important components of the fauna of southeast Asia and adjacent islands. One concern of these investigations is the extent of parallel morphological diversification of adults and larvae. Another concern is the relation between morphogenetic constraints and ecological distribution in larvae.

I am interested in advising students working in community ecology in tropical forests or developmental morphology of anuran larvae.

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1986. (with H. K. Voris and K. J. Frogner) Organization of a community of tadpoles in rain forest streams in Borneo. Journal of Tropical Ecology 2: 193-205.

1989. (with E. Nodzenski and R. J. Wassersug) Developmental differences in visceral morphology in megophrynine pelobatid tadpoles in relation to their body form and mode of life. Biological Journal of the Linnean Society 38: 369-388.

1991. Uncoupling of related structural changes in metamorphosing torrent-dwelling tadpoles. Copeia 1990: 1047-1054.

1992. Variation in apomorphic characters in the stream-dwelling tadpoles of the bufonid genus *Ansonia*. Zoological Journal of the Linnean Society 105: 225-237.

1992. (with R. B. Stuebing) The montane amphibian fauna of northwestern Borneo. Malayan Nature Journal 46: 41-51.

1993. (with H. K. Voris) A comparison of amphibian communities through time and from place to place in Bornean forests. Journal Tropical Ecology 9: 409-433.

1994. (with R. B. Stuebing.) First record of the lizard genus *Pseudocalotes* (Lacertilia: Agamidae) in Borneo, with descriptiom of a new species. Raffles Bulletin of Zoology 42(4): 961-965.

WENDY M. JACKSON

Coordinator, Advanced Training Program in the Conservation of Biological Diversity (A Consortium of The Field Museum, Chicago Zoological Society, and University of Illinois at Chicago); Visiting Lecturer, University of Illinois at Chicago.

B.S., Ecology, Ethology and Evolution, University of Illinois at Urbana-Champaign, 1982.
Ph.D., Zoology, University of Washington, Seattle, 1990.

Science, Engineering and Diplomacy Fellow (Sponsored by the American Association for the Advancement of Science), U.S. Agency for International Development, Washington, DC, 1991-1993.
Postdoctoral Research Associate, Burke Museum, University of Washington, 1990-1991.

Conservation biology/biological diversity/behavioral ecology/evolution of social behavior.

I am interested in exploring multidisciplinary approaches to the conservation of biological diversity. Sustainable solutions to problems in conservation biology must involve people with a wide variety of backgrounds in the natural sciences, as well as people with expertise in economics, sociology and politics. In addition, conservation of biological diversity in tropical countries, where diversity is greatest, can be achieved only through the active involvement of researchers, wildlife managers, community development workers and other professionals from those countries. The Advanced Training Program in the Conservation of Biological Diversity (ATP), which I coordinate, is designed to provide these professionals with the multidisciplinary background necessary for them to provide leadership in conservation biology in their own countries.

While the main focus of the program has been on bringing developing-country professionals to Chicago, we recognize that the impact of the program can be enhanced through follow-up activities in the home countries of the participants. I recently began a training and research program in Kenya with one of the past participants. The program included pilot studies on the causes and consequences of fragmentation of the Kakamega Forest in western Kenya. Kakamega Forest is a remnant of the once vast tropical rainforest that stretched across equatorial Africa, and is home to many species found nowhere else in Kenya. Encroachment on the forest by the rapidly increasing human population poses a serious and imminent threat to the biodiversity of the forest. We plan to continue these pilot projects to find solutions that benefit both the forest and the people.

In addition to my interests in conservation biology, I have a continuing interest in behavioral ecology and the evolution of social behavior, especially of African birds. I am especially interested in the causes and consequences of conspecific brood parasitism in weaverbirds and other birds.

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1992. Estimating conspecific nest parasitism in the Northern Masked Weaver based on within-female variability in egg appearance. Auk 109:435-443.

1992. Relative importance of parasitism by *Chrysococcyx* cuckoos versus conspecific nest parasitism in the Northern Masked Weaver *Ploceus taeniopterus*. Ornis Scandinavica 23:203-206.

1993. Causes of conspecific nest parasitism in the northern masked weaver. Behavioral Ecology and Sociobiology 32:119-126.

(In press.) Egg-discriminating ability and egg-color variability in the Northern Masked Weaver. In: Parasitic Birds and Their Hosts: Behavioral, Ecological, and Evolutionary Interactions. (Ed. S.I. Rothstein and S. K. Robinson). Oxford University Press, New York.

JULIAN C. KERBIS PETERHANS

Research Associate, Mammals, Department of Zoology, Field Museum; Adjunct Faculty, Department of Anthropology, University of Chicago; Visiting Assistant Professor, Roosevelt University.

B.Sc., Biology, Beloit College, Beloit, Wisconsin, 1974.
M.A., Anthropology, University of Chicago, 1979.
Ph.D., Anthropology, University of Chicago, 1990.

Consultant, United States Fish and Wildlife Service, National Forensics Laboratory.
Post-doctoral Curatorial Associate, African mammals, Field Museum, 1990-1993.
Collection Manager, Division of Mammals, Field Museum, 1987-1989.
Lecturer, Loyola University of Chicago, Department of Anthropology, 1983-1984.
Lecturer, Beloit College, Archaeological Field School.

Biogeography and systematics of African mammals, behavioral ecology of the Carnivora, evolution of the Hominoidea, faunal analysis, taphonomy.

Research programs have been directed in two directions, one zoogeographic, the other taphonomic. For the past 4 years, small mammal surveys in the mountains astride the Albertine Rift have shown that these mountains house: 1) independent small mammal faunas but with numerous elements in common 2) Africa's richest soricid community, indicating that this area has been fundamental in the origin, diversification and maintenance of African shrews, and 3) Africa's richest endemic small mammal community, speaking to the long term isolation and stability of the region. Comprehensive surveys of small mammals from these isolated mountain tops are continuing in order to: a) assess the biogeographic history of the different mountain tops by comparing faunal communities within and among adjacent lowland and montane communities and more distant montane regions, and b) develop phylogenetic hypotheses for groups which are well represented in both montane and lowland regions (e.g., Soricidae and Murinae).

Taphonomic projects include wide-ranging inquiries into patterns of predation, specifically among felids and primates, carnivores and ungulates, eagles and primates, and owls and rodents. Data gathered includes analyses of sex and age, species composition, and body part selection and destruction. These analyses are fundamental in establishing predator-specific 'fingerprints' and in deducing sociobiological attributes of prey and predator behavior.

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1993. (with R. W. Wrangham, M. L. Carter and M. D. Hauser) A contribution to tropical rain forest taphonomy: retrieval and documentation of chimpanzee remains from Kibale Forest, Uganda. Journal of Human Evolution 25: 485-514.

(in press) (with J. M. Fay, R. Carroll and D. Harris) Leopard-Gorilla Interactions in Central African Republic. Journal of Human Evolution.

(in press) Bone Gathering Activities of Hyenas, Leopards and Porcupines: Implications for Paleoanthropology. University of Chicago Press.

(in press) (with B. D. Patterson) A reappraisal of the semi-aquatic mouse, *Nilopegamys* (Osgood) and its evolutionary implications. Zoological Journal of the Linnean Society, London.

1994. The African Leopard: Ecology and Behavior of a Solitary Felid, by T. N. Bailey (book review). Journal of Mammalogy 75(4): 1093-1094.

JOHN KETHLEY

Associate Curator, Insects, Department of Zoology, Field Museum; Lecturer, Committee on Evolutionary Biology, University of Chicago; Lecturer, Department of Entomology, Ohio State University.

B.S., Botany, University of Georgia, 1964.
Ph.D., Entomology, University of Georgia, 1969.

NIH Post-doctoral Trainee, The Acarology Laboratory, Ohio State University.

Systematics/phylogeny/comparative developmental morphology/zoogeography and cytology of acariform mites.

Research interests lie in two areas: 1) chelicerae terrestrialization and the evolution of mites; 2) the evolution of meiosis.

Chelicerates, including mites, were among the first arthropods to have colonized land (Devonian or earlier). The contemporary distribution of early lineages appears to reflect their ancestral coastal, fluvial or alluvial habitats . Research is focused on documentation of the global species diversity, community structure, zoogeography and phylogenetic relationships of these microarthropods. Parallel research seeks to integrate paleogeographic, paleoclimatic and tectonic data to clarify contemporary distributions and identify regions that may have been involved in significant extinction events.

Standard paradigms of evolutionary genetics preclude the accumulation of significant biological diversity within wholly thelytokous lineages. Collaborative research with Roy Norton, S.U.N.Y., Syracuse, has documented the existence of a very large monophyletic lineage of entirely thelytokous oribatid mites that he hypothesized to have given rise to an even larger lineage of bisexual mites, the astimata. Parallel collaborative research with Dana Wrensch, Ohio State University, reassessed cytological mechanism of the thelytokois arthropods. Our reinterpretation of the little known pattern of inverted meiosis, where sister chromatids separate in anaphase I, formed the basis of a mechanism that would permit long term success and diversification of thelytokous mites. Our survey of eukaryote cytology indicated widespread occurrence of inverted meiosis in most groups (excluding deuterostomes) sugggesting that inverted meiosis was ancestral and had independently given rise to "normal meiosis" numerous times. We are pursuing molecular and cytological ramifications of this hypothesis.

I would be pleased to work with graduate students interested in either the evolution of chelicerae terrestrialization or meiotic patterns.

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1982. Acariformes: Prostigmata Pp. 117- 145. In: S. P. Parker (ed). Synopsis and Classification of Living Organisms Vol. 2. McGraw-Hill.

1989. (with R. A. Norton, P. M. Bonamo and W. A. Shear) A terrestrial alicorhagiid mite (Acari: Acariformes) from the Devonian of New York. Micropaleontology 35(4): 367-373.

1990. Acarina: Prostigmata (Actinedida). Pp. 667-756. In: D. Dindel (ed). Soil Biology Guide. John Wiley and Sons, New York.

1993. (with R. A. Norton, D. E. Johnston and B. M. O'Connor) Phylogenetic Perspectives on Genetic Systems and Reproductive Modes of Mites. Pp. 8-99. In: D. L. Wrensch and M. Ebbert (eds.) Evolution and Diversity of Sex Ratio in Insects and Mites Chapman and Hall, New York.

1994. (with D. L. Wrensch and R. A. Norton) Cytogenetics of Holokinetic chromosomes and Inverted Meiosis: Keys to the Evolutionary success of Mites, with Generalizations of Eukaryotes. Pp. 282-343. .In: M. Houck (ed.), Mites: Ecological and Evolutionary Analyses of Life-History Patterns, Chapman and Hall, New York.

CHAPURUKHA MAKOKHA KUSIMBA

Assistant Curator of African Archaeology and Ethnology, Department of Anthropology, Field Museum; Research Associate, Institute of African Studies, University of Nairobi, Kenya.

B.Ed. African History and Kiswahili, Kenyatta University, 1986.
Ph.D. Anthropology, Byrn Mawr College, 1993.

Technology, Trade and Urbanism on the Precolonial Kenya Coast

Since 1986 I have been carrying out anthropological research on the Kenya Coast with the aim of understanding the development of complex Swahili polities of the East African coast from 700 AD to 1500 AD. I completed the first phase of this project that involved the archaeological and ethnoarchaeological survey of iron production in 1992. Since joining Field Museum in 1994 I have continued archaeological fieldwork on the Kenya Coast with the aim of understanding : (1) the role of local craft production, especially iron production, in the development of political and economic relationships between the East African Coast and its Indian Ocean trading partners; (2) the early Indian Ocean trade as a stimulus for technical innovation, economic profit, and as a conduit for the bi-directional transfer of technologies between East Africa, the Middle East, and South Asia; and (3) the role of coastal and interior peoples in the organization, production, use and trade of local crafts, and the role of productive organization in the development of social stratification. The project is being carried out at the archaeological site of Mtwapa and its hinterland, Kenya. This year, I begun a collection-based study of the Linton Madagascar collection at The Field Museum in collaboration with Dr. Bennet Bronson (Anthropology). The Linton collection includes nearly 3700 items form all the main ethnic divisions of Madagascar. This study will be published in a book on the material culture of Colonial Madagascar.

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1992. Iron Working and Culture Change among the Waswahili of Kenya: Progress Report of Mtwapa Anthropological Research Project. Mvita: Newsletter of the Center for the Study of Urban Origins in Eastern and Southern Africa 4:5-8.

1993. Report on ongoing and completed Projects of 1993. Mvita: Newsletter of the Center for Study of Urban Origins in Eastern and Southern Africa 5:7-8.

1994. (with D. Killick and R.G. Creswell) Indigenous and Imported Metals in Swahili Sites on the Kenyan Coast. MASCA Research Papers in Science and Archaeology. 11:63-78.

1994. Chinese Ceramics in the Fort Jesus Collection. Kenya Past and Present 26:55-57.

1996. (in press) The Evolution of Swahili City States in East Africa: Archaeological Research in Historical Perspective. In P.J.J. Sinclair (ed.) One World Archaeology Series. Routledge.
1996. (in press) Kenya's Destruction of Swahili Cultural Heritage. In R. McIntosh and P.R. Schmidt (eds.) Plundering Africa's Past. Indiana University Press.

1996. (in press) Spatial Organization at Swahili Archaeological Sites in Kenya. In G. Pwiti and R. Soper (eds.), Proceedings of the 10th Panafrican Congress of Prehistory and Related Studies. University of Zimbabwe Press.

(in press) Archaeology in African Museums. African Archaeological Review.

THOMAS G. LAMMERS

Assistant Curator, Vascular Plants, Department of Botany, Field Museum.

B.S., Botany, Iowa State University, 1977.
M.A., Biology, University of Northern Iowa, 1981.
Ph.D., Botany, The Ohio State University, 1988.

Standing Committee for Botany, Pacific Science Association.
Education Committee, Botanical Society of America.
Numerous field research expeditions to Hawaiian Islands, Chile, Taiwan, funded by Sigma XI, NSF, William Sherman Turrell Herbarium Fund, National Geographic Society.
Visiting Assistant Professor, Miami University, 1988-1990.
Taught at University of Illinois at Chicago in 1992 and 1993 (plant taxonomy), and at University of Chicago in 1994 (biodiversity).

Systematics and evolution of the Campanulaceae, especially subfamily Lobelioideae; cytology and cytoevolution; island biology; co-evolution of plants and pollinators.

My research interests are the evolution and classification of flowering plants. Current focus is the family Campanulaceae, in particular subfamily Lobelioideae. Specific goals are to understand the patterns of evolutionary diversification in the group; to identify the biological processes responsible for those patterns; and to provide a sound and useful classification of the group on this basis. In meeting these goals, I embrace the concept that the best results are obtained through the rigorous and objective synthesis of diverse kinds of data. Work at present involves several poorly understood clades in the Hawaiian Islands, Chile, and the Caribbean; patterns of chromosomal evolution in the group as a whole; and an attempt to elucidate overall evolutionary patterns in the family.

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1992. Circumscription and phylogeny of the Campanulales. Annals of the Missouri Botanical Garden 79: 388-413.

1992. Systematics and biogeography of the Campanulaceae of Taiwan. Pp. 43-61 in: C.-I Peng (ed.) Phytogeography and Botanical Inventory of Taiwan. Academia Sinica, Taipei.

1993. A new species of *Siphocampylus* (Campanulaceae: Lobelioideae) from northern Peru. Brittonia 45: 28-31.

1993. Chromosome numbers of Campanulaceae. III. Review and integration of data for subfamily Lobelioideae. American Journal of Botany 80: 660-675.

1993. (with D. L. Kama and N. R. Morin) Campanulaceae. Pp. 310-326 In: L. Brako and J. L. Zarucchi, Catalogue of the Flowering Plants and Gymnosperms of Peru. Missouri Botanical Garden, St. Louis.

1994. (with M. E. Cosner and R. K. Jansen) Phylogenetic relationships in the Campanulales based on *rbc*L sequences. Plant Systematics and Evolution 190: 79-95.

1994. Typification of the names of Hawaiian Lobelioideae (Campanulaceae) published by Wilhelm Hillebrand or based upon his specimens. Taxon 43: 545-572.

1994. (with G. R. Proctor) *Lobelia vivaldii* (Campanulaceae: Lobelioideae), a remarkable new species of sect. *Tylomium* from Isla de Mona, Puerto Rico. Brittonia 46: 273-278.

1995. Patterns of speciation and biogeography in the endemic Hawaiian genus *Clermontia* (Campanulaceae: Lobelioideae). Pp. 338-362. In: W. L. Wagner and V. A. Funk. eds.), Hawaiian Biogeography: Evolution of a Hot Spot Archipelago. Smithsonian Institution Press, Washington.

1995. Transfer of the southern African species of *Lightfootia*, nom. illeg., to *Wahlenbergia* (Campanulaceae, Campanuloideae. Taxon 44: 333-339.

SCOTT LIDGARD

Associate Curator, Fossil Invertebrates, Department of Geology, Field Museum; Lecturer, Committee on Evolutionary Biology, University of Chicago.

B.S., University of California at Santa Cruz, Earth and Planetary Sciences, 1976.
M.S., Paleobiology, University of Rochester, Geological Sciences, 1979.
Ph.D., Paleobiology, The Johns Hopkins University, Earth and Planetary Sciences, 1984.

Predoctoral Fellow, Paleobiology, Smithsonian Institution, 1982.
NATO Postdoctoral Fellow, British Museum (Natural History), 1984.
Chair, Association of North America Paleontological Societies.
Associate Professor (Adjunct), Biological Sciences, University of Illinois at Chicago, 1994.

Evolution and ecology of cheilostome bryozoans, particularly the relationships of colonial growth and form/evolutionary paleoecology and the resolution of large-scale patterns in the fossil record/angiosperm diversification and Cretaceous floristic trends.

Research focuses on the roles of different modes of growth in large scale patterns of cheilostome bryozoan evolution, environmental distribution, and ecology. My previous work on comparative skeletal ontogenies of zooids within colonies recognized characteristic zooid budding patterns of encrusting cheilostomes. More recently I have synthesized the overriding evolutionary trends in predominant modes of growth in this group, documenting a persistent evolutionary transition in which one mode of growth is supplanted by another during the past 100 million years. In an environmental context, this work has also provided a novel test of paleoenvironmental studies of other groups of marine benthos in which onshore origin was followed by expansion into offshore, deeper water marine environments.

A related research problem involves re-evaluating the role of competition in large-scale evolutionary replacements such as dinosaurs versus mammals or brachiopods versus clams. This work on cheilostome and cyclostome bryozoans has produced surprising results—the pattern of replacement differs when species, genera, or families are used as the basis for the analysis.

Collaborative research (with P. R. Crane) examines large-scale floristic patterns during the radiation of angiosperms. We have employed trend surface analyses to demonstrate a striking latitudinal shift (from tropical to boreal) in the pattern of increasing angiosperm dominance through the Cretaceous. This work is part of more comprehensive synthesis of paleolatitudinal and temporal trends in the apparent diversity of all Cretaceous land plants. We have also attempted to clarify the rate and magnitude of angiosperm radiation using the parallel fossil records of leaves and pollen/spores, to provide a deductive test of evolutionary tempo during the diversification of a major group of organisms.

Morphometric analyses of New Zealand bryozoans (Lidgard and Buckley 1994) indicate that traditional taxonomic practices are inadequate in their ability to distinguish species level taxa in *Adeonellopsis*, and quite possibly in cheilostome bryozoans as a whole. The implications of this result are that currently recognized species may underestimate cheilostome diversity by a factor of two, three, or more.

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1990. (with P. R. Crane) Angiosperm diversification and Cretaceous floristic trends: a comparison of palynofloras and leaf macrofloras. Paleobiology 16: 77-93.

1993. (with F. K. McKinney and P. D. Taylor) Competition, clade replacement, and a history of cyclostome and cheilostome bryozoan diversity. Paleobiology 19: 352-371.

1994. Toward a morphological species concept in Cheilostomes: phenotypic variation in *Adeonellopsis yarraensis* (Waters). Pp. 101–106 In: P. J. Hayward, J. A. Ryland and P. D. Taylor (eds.), Biology and Paleobiology of Bryozoans. Olsen and Olsen, Fredensborg.

PETER E. LOWTHER

Research Associate, Birds, Department of Zoology, Field Museum.

B.S., Zoology, Iowa State University, 1970.
M.A., Systematics and Ecology, University of Kansas, 1976.
Ph.D., Systematics and Ecology, University of Kansas, 1979.

Elective Member, American Ornithologists' Union.
Editor for North American Bird Bander, Inland Bird Banding Association.

Brood parasitism, population biology of passerine birds.

Research interests are concerned with breeding biology at a population or community level and investigations to help understand brood parasitism. Active projects include monitoring breeding biology of a suburban nesting colony of House Sparrows; study of brood parasitism in birds, specifically Brown-headed Cowbirds, based on field studies and museum collections; and structure of tallgrass prairie bird communities.

* * *

1975. Geographic and ecological variation in the family Icteridae. Wilson Bulletin 87: 481-495.

1977. Selection intensity in North American House Sparrows *Passer domesticus*. Evolution 31: 649-656.

1983. Breeding biology of House Sparrows: intercolony variation. Occasional Papers, Museum of Natural History, University of Kansas, No. 107:1-17.

1984. Cowbird nest selection. Wilson Bulletin 96:103-107.

1988. Breeding biology of House Sparrows: patterns of intra-clutch variation in egg size. In: J. Pinowski and J. D. Summers-Smith (eds.), Granivorous birds in agricultural landscapes, PWN-Polish Scientific Publishers, Warszawa.

1992. (with C. L. Cink) House Sparrow. In: A. Poole, P. Stettenheim and F. Gill (eds.)., The Birds of North America, No. 12 Philadephia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.

1993. Brown-headed Cowbird. In: A. Poole and F. Gill (eds.)., The Birds of North America, No. 47 Philadephia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.

FRANÇOIS LUTZONI

Assistant Curator, Lichen-forming Fungi, Department of Botany, Field Museum.

B.Sc., Université Laval, Canada, 1987.
M.Sc., University of Ottawa, Canada, 1990.
Ph.D., Duke University, 1995.

Postdoctoral Research Associate, Department of Biology, Indiana University at Bloomington, 1996.
A.W. Mellon Junior Fellow, Lab. of Molecular Systematics, Smithsonian Institution, 1994.
Mycological Society of America Graduate Fellowship, 1993.
New England Botanical Club Award for the Support of Botanical Research, 1992.
A. J. Sharp Award, American Bryological and Lichenological Society, 1989.
Lionel Cinq-Mars Award, Honorable Mention, Canadian Botanical Association, 1989.

Molecular and morphological systematics of lichen-forming fungi, and evolutionary studies of symbiosis using lichens as model systems.

My research interest is centered on lichens and symbiosis. It covers five major topics: (1) Floristics and systematics of lichens using both morphological and molecular data. (2) Requirements and consequences for a transition to mutualism during the evolution of fungi; this work is done on a model system including both lichen-forming and closely related non-lichenized *Omphalina* species. Data from this model system are gathered through *in vitro* experiments and molecular evolutionary studies. The data generated are analyzed using comparative methods. (3) Macroevolutionary studies of lichenized and non lichenized Ascomycetes; this research project is aimed toward a better understanding of the relationships among orders of ascomycetes using molecular and morphological data sets. (4) Phylogenetic reconstruction theory; I am interested more specifically in combinability testing methods and problems associated with resolving phylogenetic relationships among many taxa. As we try to solve phylogenetic relationships among larger numbers of taxa, the need for multiple data sets becomes increasingly acute. Combinability testing is not only a way to determine if data sets should be combined in their entirety, but is also a tool for exploring the specific characteristics of each data set that cause phylogenetic incongruence. (5) Cospeciation between lichen-forming fungal species and their algal symbiont *Coccomyxa* (Chlorophyta); I am currently addressing this issue by sequencing the same genes in both the fungal and algal partners of distinct lichen populations for different lichen species.
I would be pleased to supervise students interested in any of the topics mentioned above.

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1988. (with L. Sirois and M. M. Grandtner) Les lichens sur serpentine et amphibolite du plateau du mont Albert, Gaspésie, Québec. Canadian Journal of Botany 66: 851-862.

1994. (with R. A. Vilgalys) *Omphalina* (Basidiomycota, Agaricales) as a model system for the study of coevolution in lichenized fungi. Special Issue of Cryptogamic Botany 5: 82-97.

1994. *Ionaspis alba* (Ascomycotina, Hymeneliaceae), a new lichen species from eastern North America. The Bryologist 97: 393-395.

1994. (with I. M. Brodo) Proposal to conserve the name *Gyalecta suaveolens* Fr. (lichenized Ascomycota) with a conserved type. Taxon 43: 657-659.

1995. (with I. M. Brodo) A generic redelimitation of the *Ionaspis-Hymenelia* complex (lichenized Ascomycotina). Systematic Botany 20: 224-258.

1995. (with R. Vilgalys) Integration of morphological and molecular data sets in estimating fungal phylogenies. Canadian Journal of Botany 73 (Suppl. 1): S649-S659.

1996. Phylogeny of lichen- and non lichen-forming omphalinoid mushrooms and the utility of testing for combinability among multiple data sets. Systematic Biology (submitted).

GARY L. SMITH MERRILL

Research Associate, Bryology, Department of Botany, Field Museum.

B.A., Botany, State University of Iowa, Iowa City, 1962.
M.S., Botany, State University of Iowa, Iowa City, 1964.
Ph.D., Botany, Columbia University, New York, 1969.

Research Associate, Biology, Kansas State University, 1988-1992.
Assistant Professor, Botany, Drew University 1977-1979, 1980-1986.
Taxonomist, Jardin Botánico Nacional, Santo Domingo, Dominican Republic, 1979-1980.
Associate Curator (Bryophyta), New York Botanical Garden, 1969-1976.
Leader and participant in expeditions to arctic Alaska, Brazil, Japan.

Systematics and geography of mosses, particularly Polytrichaceae; floristics of Great Plains mosses; New Zealand Hepaticae.

Current research projects include preparation of treatments of Polytrichaceae (10 genera, 48 spp) for Volume 13 of Flora of North America (currently work is concentrated on the genus *Atrichum*); an outline of a revised and updated classification of the family; study of collections of Polytrichaceae from central America and elsewhere sent to me for identification; and a monographic study of the Australasian hepatic genus *Telaranea* (with Dr. John Engel). 1993 saw publication of my treatment of Polytrichaceae as part of the Moss Flora of Mexico, as well as several journal articles.

My research has been concerned chiefly with the Polytrichaceae, a family of mosses of world-wide distribution, composed of 22 genera and an estimated 300 species. The family represents an isolated group, with no extant (or known fossil) relatives, and is notable for the structural complexity of both gametophyte and sporophyte generations, and a number of features not found in any other group of bryophytes. They are the only mosses with specialized internal conducting tissues, comparable to those of simple vascular plants.

I have also a continuing interest in the bryoflora of the Great Plains region. An important recent discovery is the new moss genus and species, *Ozobryum ogalalense* Merrill, restricted to NW Kansas and adjacent Nebraska. Bryophytes are capable of persisting as distributional relicts which reflect past climatic conditions and floras, and endemics such as *Ozobryum* may be clues to earlier regional floras of which they are the sole survivors. A more thorough knowledge of the bryophytes of the Great Plains should provide insights into the complex vegetational history of the region.

* * *

1969. On *Atrichopsis*, with notes on some austral *Psilopilum* species (Polytrichaceae). Bulletin of the Torrey Botanical Club 96: 60-69.

1971. Conspectus of the genera of Polytrichaceae. Memoirs of the New York Botanical Garden 21(3): 1-80.

1975, 1976. Polytrichaceae. In: Ohashi, H. The Fora of Eastern Himalaya. University Museum Tokyo Bulletin 8: 244-246. and Addendum to the Polytrichaceae of "Flora of Eastern Himalaya" Journal of the Hattori Botanical Laboratory 41: 419-425.

1991. *Oligotrichum denudatum* (Polytrichaceae), a new moss species from Minas Gerais, Brazil. Novon 1: 107-109.

1992. *Ozobryum ogalalense* Pottiaceae), a new moss genus and species from the American Great Plains. Novon 2: 255-258.

1992. Notes on North American Polytrichaceae: *Polytrichastrum* G. Sm. The Bryologist 95: 270-273.

1994. Polytrichaceae. In: Sharp, A. J., H. A. Crum and P. M. Eckel (eds.) The Moss Flora of Mexico. Memoirs of the New York Botanical Garden 69: 1068-1092.

GREGORY M. MUELLER

Associate Curator, Mycology and Head, Cryptogams, Department of Botany, Field Museum; Lecturer, Committee on Evolutionary Biology, University of Chicago; Adjunct Associate Professor, Department of Biological Sciences, University of Illinois, Chicago.

B.A., Southern Illinois University, Carbondale, 1976
M.S., Southern Illinois University, Carbondale, 1979
Ph.D., The University of Tennessee, Knoxville, 1982

Associate Editor, Mycologia
Advisory Panel, Systematic Biology Program, National Science Foundation, 1992, 1993, 1995
Councilor for Systematics and Evolution, Mycological Society of America, 1993-1996
Alexopoulos Prize, The Mycological Society of America, 1992
Visiting Scientist, Institute of Physiological Botany, Uppsala University, Sweden, 1982-1983
Postdoctoral Fellow, Mountain Lake Biological Station, Pembroke, VA. 1983
Postdoctoral Research Associate, Dept. of Botany, University of Washington, Seattle, WA. 1984-1985

Systematics, population biology, biogeography, and ecology of Fungi

My research program centers on the systematics, ecology, and evolution of higher fungi and the mutualistic symbiosis that some of them form termed mycorrhizae. Three long-term projects are currently receiving most of my attention: 1) A survey of mushrooms and related fungi of the Costa Rican tropical oak forests. This study is being supported by grants from the National Science Foundation with the U.S.-Agency for International Development and the National Institutes of Health. Goals of this study are to: a) develop the first comprehensive survey of higher fungi from the neotropics, b) build scientific infrastructure in Costa Rica through training of graduate students and improving facilities, and c) screen fungi for anti-AIDS and anti-cancer compounds. 2) A survey of mushrooms and related fungi occurring in northern Illinois and Indiana to determine species composition, distribution, and host specificity and to assess the effect of air pollution on fungi in the region. 3) A monographic study of the genera *Hydnangium*, *Laccaria*, and *Podohydnangium*. This work is designed to test various theories of speciation, coevolution (with their obligate tree symbionts), and biogeography of fungi that form ectomycorrhizae. These projects entail an active field work component as well as laboratory studies that include micromorphological analyses (computer-aided light microscopy, SEM, and TEM), examination of in vitro culture morphology, pairing studies, and DNA sequencing. These interrelated projects are providing information on fungal ecology and biology that are crucial to temperate and tropical forest management and conservation.

* * *

1992. Systematics of *Laccaria* (Agaricales) in the continental United States and Canada, with discussions on extralimital taxa and descriptions of extant types. Fieldiana: Botany, new series 30: 1-158.

1993. (with J. F. Ammirati). Cytological studies in *Laccaria* (Agaricales). II. Assessing phylogenetic relationships among *Laccaria*, *Hydnangium*, and other Agaricales. American Journal of Botany 80: 322-329.

1993. (with A. von Hofsten, A. Axén, and B. A. Strack). Basidiospore wall ultrastructure of the false-truffle *Hydnangium* and its phylogenetic significance. Mycologia 85: 890-893.

1994. (with E. M. Pine) DNA data provide evidence on the evolutionary relationships between mushrooms and false truffles. McIlvainea 11(2): 61-74.

1995. (with R. E. Halling) Evidence for high biodiversity of Agaricales (Fungi) in neotropical montane *Quercus* forests. Pp. 303-312. In: S. P. Churchill et al. (eds.), Biodiversity and Conservation of Neotropical Montane Forests. The New York Botanical Garden Press.

JOHN F. MURPHY

Postdoctoral Research Associate, Department of Botany, Field Museum.

Deep Springs College, 1978-1980.
B.A., Environmental Biology, Humboldt State University, 1987.
M.S., Biology, Virginia Polytechnic Institute and State University, 1992.
Ph.D., Biology, Virginia Polytechnic Institute and State University, 1995.

Ecology, population biology, and conservation of Basidiomycetes.

My current research activities encompass all Chicago-area fungal biodiversity assessments in which The Field Museum is involved. These assessments are focused on the effects of prairie-oak savanna restoration treatments on fungal species diversity (using both above- and below-ground approaches), the effect of air pollution on local species diversity and the possibility of heavy-metal accumulation by fungi in areas of high pollution deposition. In addition to intensive sampling in this region, I am also using The Field Museum's extensive collections and database to compile a species list of fungi from northern Illinois and Indiana, and to document possible changes over time.

The activities described above dovetail with the Chicago Wilderness initiative, which involves a coalition of agencies interested in maintaining the high biodiversity of the greater Chicago region. I am currently active in the Science and Land Management Teams of the Chicago Wilderness Council.

My dissertation research included a survey of the fungi occurring on permanent plots established in the southern Appalachians and focused on the population biology and ecology of two species on these plots: *Collybia subnuda* and *Marasmiellus praeacutus*. I am continuing my research on *Collybia subnuda*, since this species is an excellent organism for the study of population genetics and speciation in the gilled fungi.

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1992. Ecology and population biology of two litter decomposing basidiomycetes. Master's thesis, Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

1993. (with O. K. Miller, Jr.) The population biology of two litter decomposing agarics on a southern Appalachian mountain. Mycologia, 85(5): 769-776.

1994. (with O. K. Miller, Jr.) Mycorrhizal syntheses with *Alnus serrulata* (Ait.) Willd. Castanea 59(2): 156-166.

1995. Microevolutionary studies in *Marasmiellus praeacutus* and *Collybia subnuda*, two litter-decomposing basidiomycetes. Doctoral dissertation, Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

In review. Diversity and local distribution of mating alleles in *Marasmiellus praeacutus* and *Collybia subnuda* (Basidiomycetes, Agaricales). (with O. K. Miller, Jr.)

In review. Intersterility groups in *Collybia subnuda*.

In preparation. A novel application of spore trapping allows species-specific quantification of viable spore deposition.

MICHAEL NEDBAL

Postdoctoral Research Scientist, Department of Geology, Field Museum

B.S., Biology, University of Illinois, 1989
Ph.D., Genetics, Texas A&M University, 1995

Systematics and historical biogeography of eutherian mammals.
Interactions between molecular evolution biases and phylogeny reconstruction.

My research interests are in molecular evolution, systematics, conservation biology, and population biology/population genetics. Specific interests are as follows: 1) processes of molecular evolution and how these processes affect patterns of genetic variation within and between species; 2) systematics and biogeography of organisms, especially vertebrates, and combining information from molecular, morphological, and paleontological evidence in an effort to unravel patterns of biodiversity; 3) developing experimental approaches for studying genetic variation; 4) using genetic and morphological variation to assess conservation issues and to promote policy involving those issues.

I am currently studying the phylogenetic relationships among the mammalian order Carnivora by integrating molecular, morphological, and paleontological data. In concert, these data also will be used to test models of neutrality and the molecular clock hypothesis. Do molecules change at a constant rate through time (molecular clock), or are patterns of episodic change evident, suggesting non-neutral processes? By using fossil calibration dates to split lineages into smaller fragments of evolutionary time we will be able to measure microevolutionary change over a broad range of geologic time.

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1994. (with M. W. Allard and R. L. Honeycutt) Molecular systematics of hystricognathid rodents: evidence from the mitochondrial 12S rRNA gene. Molecular Phylogenetics and Evolution 3: 206-220.

1994. (with D. P. Philipp) Differentiation of mitochondrial DNA in largemouth bass. *Micropterus salmoides*. Transactions of the American Fisheries Society 123: 460-468.

1995. (with R. L. Honeycutt, R. M. Adkins, and L. J. Janecek) Mammalian mitochondrial DNA evolution: a comparison of the cytochrome b and cytochrome c oxidase II genes. Journal of Molecular Evolution 40: 260-272.

ALFRED F. NEWTON, JR.

Associate Curator and Head, Insects, Department of Zoology, Field Museum.

A.B., Chemistry, Rutgers University, 1966.
A.M., Chemistry, Harvard University, 1970.
Ph.D., Zoology, Harvard University, 1973.

Editorial Board, Psyche, 1978-1986.
Australian Biological Resources Study.
Field Research program supported by NSF, American Philosophical Society, Ernst Mayr Grant, National Geographic Society.
Councilor, Coleopterists Society (1993-1994).

Phylogeny, comparative morphology and evolution of beetles; historical biogeography; insect association with specialized microhabitats.

My current research revolves around studies on the evolution of the large beetle family Staphylinidae (over 45,000 named species). A long-term study of the higher-level classification and evolution of the group continues by focusing on reconstructing the phylogeny of one of the family's four main lineages. I have nearly completed a monographic study of the 190+ New World species of the genus *Platydracus*, whose species promise to be of special interest for understanding the origin of current distribution patterns of forest-dwelling insects in Mexico and Central America. Collaboration with M.K. Thayer continues on another long-term project to improve knowledge of the staphylinoid beetle fauna of Australia and other southern temperate areas, with the ultimate aim of using this group to help understand the origin of southern disjunct distribution patterns (Australia+New Zealand+Chile) that are very common within the group.

* * *

1982. (with J. F. Lawrence) Evolution and classification of beetles. Annual Review of Ecology and Systematics 13: 261-190.

1984. Mycophagy in Staphylinoidea (Coleoptera). Pp. 302-353. In: Fungus/Insect Relationships, Q. Wheeler and M. Blackwell (eds.), Perspectives in Ecology and Evolution, Columbia University Press, New York.

1988. (with M. K. Thayer) A critique on Naomi's phylogeny and higher classification of Staphylinidae and allies (Coleoptera). Entomologia Generalis 14: 63-72.

1989. (with D. S. Chandler) World catalog of the genera of Pselaphidae (Coleoptera) Fieldiana: Zoology, n.s. 53: 1-93.

1990. Larvae of the Staphyliniformia (Coleoptera): where do we stand? Coleopterists Bulletin 44: 205-210.

1990. Staphylinidae (adults) and Staphylinidae (larvae). Pp. 1137-1174. In: D. L. Dindal (ed.), Soil Biology Guide. J. Wiley and Sons, New York.

1992. (with M. K. Thayer) Current classificaiton and family-group names in Staphyliniformia (Coleoptera). Fieldiana: Zoology, n.s. 67: 1-92.

1993. (with J. S. Ashe) Larvae of *Trichophya* and phylogeny of the tachyporine group of subfamilies (Coleoptera: Staphylinidae) with a review, new species and characterization of Trichophyinae. Systematic Entomology 18: 267-286.

MATTHEW H. NITECKI

Curator, Fossil Invertebrates, Department of Geology, Field Museum; Lecturer, Committee on Evolutionary Biology and Biological Sciences Collegiate Division, University of Chicago.

M.S., Geology, University of Chicago, 1962.
Ph.D., Paleozoology, University of Chicago, 1968.

Visiting Investigator, USSR Academy of Sciences, 1978.
Guest Scientist, USSR Academy of Sciences, 1981.
Exchange Scholar, National Academy of Sciences, 1984.
Research Scholar, Fulbright-Hays, 1985-1986.
Visiting Professor, University of Oslo, 1991-1992.
Co-Editor, Paleontological Journal (with D. V. Nitecki), Acta Paleontologica Polonica (with J. Dzik)

Problematic fossils/history and sociology of science/theoretical evolutionary biology.

Problematic Fossils: Reconstruction of the history of the biosphere is among the main goals of evolutionary biology, and problematic fossil groups play a pivotal role in this, for it is they that require us to reshape our ideas of the history of life. The problematic fossils that Nitecki studies (cyclocrinitids and receptaculitids) do not fit into any living phylum, and thus represent the record of early experiments with life.

* * *

1979. (with D.F. Toomey) Organic Buildups in the Lower Ordovician of Texas and Oklahoma. Fieldiana: Geology, n.s. 2: 1-181.

1982. (with D.C. Fisher) Standardization of the Anatomical Orientation of Receptaculitids. Paleontological Society Memoir 13: 1-40.

1985. (with A. Hoffman) Reception of the asteroid hypothesis of terminal Cretaceous extinctions. Geology, 13 (2): 884-887.

1986. (with A. Hoffman) (eds.) Problematic Fossil Taxa. Oxford University Press.

1988. Evolutionary Progress. (ed.) University of Chicago Press.

1992. (with D.V. Nitecki) (eds.) History and Evolution. SUNY Press.

1993. (with D. V. Nitecki) (eds.) Evolutionary Ethics. SUNY Press.

1994. (with D. V. Nitecki) (eds.) Origins of Anatomically Modern Humans. Plenum Press.

BRUCE D. PATTERSON

Curator, Mammals, Department of Zoology, Field Museum; Adjunct Professor, Department of Biological Sciences, University of Illinois, Chicago; Adjunct Professor, Department of Biological Sciences, Northern Illinois University; Lecturer, Commitee on Evolutionary Biology, University of Chicago; Profesor Invitado, Museo de Historia Natural, Universidad de San Marcos, Lima, Perú.

B.S. St. Lawrence University, Biology, 1974.
M.S. New Mexico State University, Biology, 1978.
Ph.D. New Mexico State University, Biology (Experimental Statistics), 1981.

Editorial boards of Journal of Mammalogy, Biodiversity Letters, Mastozoología Neotropical.
Chairman, C. H. Merriam Award Committee, American Society of Mammalogists.
Director, American Society of Mammalogists (1989-1992, 1992-1995).

Systematics of Neotropical mammals/historical and insular biogeography/distribution and abundance.

My research is aimed at understanding the spatial and temporal organization of biological diversity, especially factors involved in the diversification and coexistence of living mammals. My field studies amass data and samples for museum-based research by me, students, and others. Commonly used approaches include statistical analysis of distribution and abundance, comparative anatomy of an increasing variety of mammal groups (particularly marsupials, bats and rodents), morphometrics, and biochemical surveys (allozymes and PCR analyses).

My conceptual contributions are principally focused on a striking distribution pattern termed "nested subsets," which has important consequences for conservation and coevolution. My empirical work helps to describe mammal taxa, identify centers of endemism, and elucidate the historical (=evolutionary and environmental) relationships among animals and regions. Students working under my direction at the University of Chicago, the University of Illinois at Chicago, and Northern Illinois University, as well as interns and visiting scholars from overseas, expand the scope and depth of these studies.

* * *

1993. (with W. Atmar) The measure of order and disorder in the distribution of species in fragmented habitat. Oecologia 96: 373-382.

1994. Accumulating knowledge on the dimensions of biodiversity: systematic perspectives on Neotropical mammals. Biodiversity Letters 2: 000-000.

1995. (with J. C. Kerbis Peterhans) The Ethiopian water mouse Nilopegamys Osgood, with comments on the evolution of semi-aquatic adaptations in African Muridae. Zoological Journal of the Linnean Society 113:1-21.

(in press) Local extinctions and the biogeographic dynamics of boreal mammals in the Southwest, In: C. Istock and R. S. Hoffmann (eds.), Storm over a Mountain Island: Conservation biology and the Mount Graham Affair. University of Arizona Press, Tucson AZ.

KATHLEEN M. PRYER

Assistant Curator, Pteridophytes, Department of Botany, Field Museum.

B.Sc., Biology, McGill University, 1976.
M.Sc., Botany, University of Guelph, 1981.
Ph.D., Botany, Duke University, 1995.

Post-doctoral Research Associate, Indiana University (Bloomington), 1996.
Katherine Stern Dissertation Fellowship, Duke University Graduate School, 1994-95.
Lawrence Memorial Award, Hunt Institute, Carnegie Mellon University, 1994.
A.W. Mellon Junior Fellowship, Molecular Systematics Lab, Smithsonian Institution, 1994.
Lionel Cinq-Mars Award (Honorable Mention), Canadian Botanical Association, 1993.
Edgar T. Wherry Award, Botanical Society of America, 1988.

Phylogenetics of pteridophytes using morphological and molecular data; Systematics of Marsileaceae, Dryopteridaceae; Ontogeny and phylogeny; Morphometrics; Biogeography.

My primary research focuses on understanding higher-level systematics and phylogeny of extant pteridophytes by integrating evidence from both morphology and molecules (multiple genes). I also use an explicit phylogenetic framework to examine the morphological evolution of various sporophytic and gametophytic characters within ferns, and to gain insight into the evolution of various life history traits that typify ferns. I have a particular interest in the aquatic, heterosporous family Marsileaceae; morphometric information on the ontogeny of leaf form in ferns has been useful in evaluating hypotheses implicating heterochronic evolution in this family. Other areas of current research interest include the integration of information from the fossil record of pteridophytes to further refine our current understanding of relationships; using morphology, isozymes, and chromosomal evidence to elucidate the systematics and evolution of cryptic species complexes (including hybrids); biogeographic, monographic, floristic, and conservation studies.

I would be pleased to work with students and other collaborators with research interests in using developmental, morphological, or molecular data for resolving systematic or phylogenetic questions in pteridophyte evolution.

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1983. (with D.M. Britton and J. McNeill). A numerical analysis of chromatographic profiles in North American taxa of the fern genus Gymnocarpium. Canadian Journal of Botany 61: 2592-2602.

1985. (with J. McNeill). The status and typification of Phegopteris and Gymnocarpium. Taxon 34: 136-156.

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1995. (with A.R. Smith and J.E. Skog) Phylogenetic relationships of extant ferns based on evidence from morphology and rbcL sequences. American Fern Journal 85: 205-282.

DAVID S. REESE

Adjunct Assistant Curator, Department of Anthropology, Field Museum.

A.B., Harvard College, 1977.
Ph.D., University of Cambridge, 1988.

Archaeozoology of the Mediterranean Basin and Near East.

I spent the first quarter of 1995 researching and writing at the American Academy in Rome. One major project was the analysis of the bones and shells from American excavations on the East Palatine, near the Coliseum and Roman Forum, another was completion of papers on the shells and fish from Pompeii and Herculaneum.

The summer of 1995 was spent on mainland Greece (working on the fauna from the University of Chicago excavations at Isthmia), Crete (shells from Greek excavations at Archanes and fauna from American excavations at Mochlos and Pseira) and Cyprus (fauna from various American and Canadian excavations).

Research and writing continues on faunal remains from Greece, Italy, Cyprus, Jordan, Syria, Lebanon, Egypt, Iraq, Iran, and Kenya.

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1988. Shells and Fish from Maa-Palaeokastro. Pp. 458-466, In: V. Karageorghis and M. Demas (eds.), Excavations at Maa-Palaeokastrol 1979-1986. Nicosia: Department of Antiquities.

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1991. The Trade of Indo-Pacific Shells into the Mediterranean Basin and Europe. Oxford Journal of Archaeology 10(2): 159-196.

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1992. Recent and Fossil Invertebrates (with a Note on the Nature of the MH I fauna). Pp. 770-778, In: W.A. McDonald and N.C. Wilkie (eds.), Excavations at Nichoria in Southwest Greece II The Bronze Age Occupation. Minneapolis: University of Minnesota Press.

OLIVIER C. RIEPPEL

Curator, Fossil Amphibians and Reptiles, Department of Geology, Field Museum; Lecturer, Committee on Evolutionary Biology, University of Chicago; Adjunct Professor of Biological Sciences, Northwestern University.

Diploma, Zoology, University of Basle, 1974.
M.Sc., Vertebrate Paleontology, University College, London, 1975.
Ph.D., Zoology, University of Basle, 1978.

Foreign Member of the Linnean Society of London, 1992.
Council, Society of Systematic Biologists, 1994.
Associate Editor, Journal of Vertebrate Paleontology, 1993-1995.
North American Editor, Zoological Journal of the Linnean Society, 1992-present.
Society of Vertebrate Paleontology: Romer Prize Committee, 1993-present.

Phylogenetic Interrelationships, Functional Anatomy and Paleobiogeography of Triassic Marine Reptiles, Sekeleton Formation in Extant Reptiles; History and Philosophy of Comparative Biology.

My research concentrates on the analysis of phylogenetic relationships of marine Mesozoic reptiles, specifically the Triassic stem-group the Sauropterygia from northwestern U.S.A., Europe (Muschelkalk, Alpine Triassic), Israel and China. Parallel studies address problems of skeleton formation in all three major clades of extant reptiles (lizards, crocodiles and turtles), focusing on patterns and sequences of ossification. These developmental data provide the basis for a better understanding of skeletal reduction in secondarily marine reptiles, such as the Sauropterygia. Studies in the philosophy and methodology of systematics and its relation to evolutionary theory have resulted in recent papers on problems of homology, historical and conceptual aspects of comparative biology, the meaning of cladistics in paleontology, and the species problem. A field program in the marine Middle Triassic of northwestern Nevada targets the collection of ichthyosaurs and sauropterygians, but has also led to the collection of associated rich and varied fossil fish faunas.

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1994. The braincases of *Simosaurus* and *Nothosaurus*: monophyly of the Nothosauridae (Reptilia: Sauropterygia). Journal of Vertebrate Paleontology 14: 9-23.

1994. Osteology of *Simosaurus gaillardoti*, and the phylogenetic interrelationships of stem-group Sauropterygia. Fieldiana: Geology, n.s. 28: 1-85.

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ANNA C. ROOSEVELT

Curator of Archaeology, Department of Anthropology, Field Museum; Professor, Department of Anthropology, University of Illinois at Chicago; Research Associate, American Museum of Natural History

B.A., History, Stanford University
M.A., Anthropology, Columbia University
Ph.D., Anthropology, Columbia University

Fellow, American Academy of Arts and Sciences
MacArthur Prize Fellowship, 1988-93
Phi Beta Kappa Visiting Scholar, 1993-94
Research Fellow, Center for Remote Sensing, Boston University
7 Research Grants from the National Science Foundation and National Endowment for the Humanities
Editorial Board, Latin American Antiquity, Latin American Anthropology Review, Prehistory press
Board of Directors, American Association for the Advancement of Science, Rainforest Alliance, Latin American Scholarship Program in American Universities
Task Force on the Environment, American Anthropological Association
Advisory Council, Wenner Gren Foundation for Anthropological Research

Human Ecology and Cultural Evolution; Environmental Archaeology; Geoarchaeology

My research focuses on the changing relationship of humans and environments. My current research project in the Brazilian Amazon (1983 to present) has uncovered a long sequence of human occupation. It begins about 11,000 years ago with cave-painting Paleoindians who subsisted on forest fruits, fish, and game. Subsequently, people in fishing villages began to make pottery, the earliest in the Americas, at c. 8000 to 5,000 years ago. Later, people began farming and by A.D. 1000 had settled in towns and built large earthworks. They traded their fine crafts long distances and fought each other for political control. I and my graduate students also are working to bring knowledge of long-term human adaptation in the Amazon to conservation and development planning in the region.

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1980. Parmana: Prehistoric Maize and Manioc Subsistence along the Amazon and Orinoco. New York: Academic Press.

1989. Resource Management in Amazonia before the European Conquest: Beyond Ethnographic Projection. Pp. 30-61, In: D. Posey and W. Balee (eds.) Natural Resource Management by Indigenous and Folk Societies in Amazonia, New York Botanical Garden: Advances in Economic Botany, No. 7.
1991. Moundbuilders of the Amazon: Geophysical Archaeology on Marajo Island, Brazil. New York, Academic Press.

1991. Determinismo Ecologico na Interpretacao do Desenvolvimento Social Indigena de Amazonia. Pp. 103-141, In: W. Neves, (ed.), Origens, Adaptacoes, e Divesidade Biologica do Homen Nativo da Amazonia. Belem: Museu Paraense Emilio Goeldi.

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1993. The Rise and Fall of the Amazon Chiefdoms. Pp. 255-384, In: A.C. Taylor and P. Descola (eds.), Le Remontee de L'Amazone: Anthropologie et Histoire des Societes Amazoniennes. L'Homme 33 (126-128), Special Issue. Paris.

1994 (editor) Indians of Amazonia from Prehistory to the Present. Tucson: University of Arizona Press.

1995 The Excavations at Corozal, Venezuela: Stratigraphy and Ceramic Seriation. Yale University Publications in Anthropology, no. 82. New Haven.

THOMAS S. SCHULENBERG

Conservation Zoologist, Environmental and Conservation Programs, Field Museum; Research Associate, Ornithology, Department of Zoology, Field Museum; Field Team Leader, Rapid Assessment Program, Conservation International.

B.A., Zoology, Humboldt State University, 1976
M.S., Zoology, Louisiana State University, 1981
Ph.D., Evolutionary Biology, University of Chicago, 1995

Editorial Board, Bird Conservation International

Avian systematics and biogeography, evolutionary biology of birds, conservation biology.

Tropical ecosystems support high levels of diversity when compared to regions in temperate latitudes. Many of these tropical areas currently face unprecedented levels of human modification or total destruction, presenting serious threats to tropical biodiversity. It is widely known that patterns of diversity and endemism vary within the tropics. The factors underlying this variation are much less understood, yet strategies for the conservation of tropical habitats must take these factors into account to be successful. My research focuses on documenting these patterns of diversity, both within and across taxa, and on using this knowledge to target conservation efforts more effectively.

Exisiting knowledge is very uneven, as a few tropical sites are very well-known, yet large areas remain poorly-studied; such gaps in our knowledge also hinder conservation efforts. The Rapid Assessment Program (RAP), a collaborative project between The Field Museum and Conservation International, is designed to quickly and effectively fill in such gaps. RAP uses our existing knowledge, satelite imagery and overflights to identify poorly-explored areas with high conservation potential, and sends small, interdisciplinary teams of highly-trained biologists into the field to make on-the-ground evaluations and conservation recommendations based on biological data.

Ultimately, the fate of tropical ecosystems rests in the hands of local communities and governments. Many sectors of society in tropical countries are showing an increased appreciation of the importance of tropical habitats, and interest in their preservation. Often, however, there are too few biologists able to provide the information needed for local conservation efforts. I am involved in several initiatives to train local biologists in rapid field survey techniques, and to develop tools that can be used to help identify, and then survey, tropical birds.

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1982. (with M. D. Williams) A new species of antpitta (*Grallaria*) from northern Peru. Wilson Bulletin 94:105-113.

1983. Schulenberg, T. S. Foraging behavior, eco-morphology, and systematics of some antshrikes (Formicariidae: *Thamnomanes*). Wilson Bulletin 95:505-521.

1985. (with L. C. Binford) A new species of tanager (Emberizidae: Thraupinae, *Tangara*) from southern Peru. Wilson Bulletin 97:413-420.

1985. (with T. A. Parker, et al.) The avifauna of the Huancabamba region, northern Peru. pp. 169-197 in Neotropical Ornithology. Ornithological Monographs No. 36, P. A. Buckley et al.(eds).

1991. (with S. M. Goodman) The rediscovery of the Red-tailed Newtonia *Newtonia fanovanae* in southeastern Madagascar with notes on the natural history of the genus *Newtonia*. Bird Conservation International 1:33-45.

1994. (with R. B. Foster, T. A. Parker, III, et al.) The Tambopata-Candamo Reserved Zone of southeastern Perú: a biological assessment. RAP Working Papers 6. Conservation International: Washington, D.C.

1995. (with N. J. Collar) (eds.) In memory of Ted Parker. Memorial volume, Bird Conservation International.

PETRA SIERWALD

Adjunct Assistant Curator, Insects, Department of Zoology, Field Museum ; Research Associate, Department of Entomology, National Museum of Natural History, Smithsonian Institution; Lecturer, Biological Sciences Collegiate Division, University of Chicago.

M.Sc., (Staatsexamen) in Biology, Geography, Biology-Education; University of Hamburg; June 1982.
Ph.D., (Dr. rer. nat.) in Zoology, University of Hamburg; March 1985.

Postdoctoral Fellow, Smithsonian Institution, Washington, DC, 1985-1986.
Researcher under German National Science Foundation Grant, 1986-1988.
Research Associate, Delaware Museum of Natural History, Wilmington, DE, 1989-1990.

Evolution of copulatory organs in spiders; Systematics of the Lycosoidea, especially phylogenetic systematic and biogeography of the spider family Pisauridae; systematics and behavior of North American black widow spiders.

Spiders have the most complex copulatory organs in the animal kingdom, but only recently has it been possible to understand this great diversity of form in terms of homologous structures. Using comparative morphological analyses for males and ontogenetic and morphological studies for females, homology-hypotheses for elements of the copulatory organs (ducts and sperm storage containers, fixation devices in the males) are generated. Ontogenetic data for females are obtained through field collecting, research on immatures, and extensive rearing programs. The molted skins containing primordia of the copulatory organs can be easily analyzed with scanning electron microscopy. The data have led to the identification of many apomorphies for groups at various levels, species-groups to major clades containing several superfamilies. Currently, work is underway to determine the mode of development and the plesiomorphic bauplan of the female copulatory organs of the clade Entelegynae, a currently weakly supported group comprising 70% of all known spider families.

Investigations into the behavior patterns exhibited during courtship and copulation in North American black widow spiders have begun. I will attempt to use behavioral elements to construct a phylogeny of North American *Latrodectus* species, since their copulatory organs lack species typical morphological characters. In collaboration with Dr. D. Smith, University of Kansas, we will also generate a phylogeny using molecular data. It is planned to expand this study in the future to include black widow species outside of North America. As more data on different species are generated, the study will allow to test hypotheses regarding mate choices made by females and males.

Systematics and biogeography of the family Pisauridae are the focus of my taxonomic work. Previous research led to the removal of 10 South American genera from the family as a separate monophyletic group, and resulted in the identification of the *Pisaura* genus-group, containing 15 genera of mainly African-Asian distribution. Work is underway to revise all 15 genera of this group, illuminate the phylogenetic relationships within the group and reconstruct the history of their distribution within a cladistic framework.

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1989. Morphology and ontogeny of female copulatory organs in American Pisauridae, with special reference to homologous features. Smithsonian Contributions to Zoology 462: 1-24.

1989. Notes on the behavior of *Thalassius spinosissimus.* Psyche 95(2): 243-252.

1990. Morphology and homologous features in the male palpal organs in spiders, with special reference to Pisauridae (Arachnida: Araneae). Nemouria 35: 1-70.

1993. Revision of the spider genus *Paradossenus*, with notes on the family Trechaleidae and the subfamily Rhoicininae (Araneae: Lycosoidea). Review Arachnologique 10(3): 53-74.

DJAJA DOEL SOEJARTO

Research Associate, Vascular Plants, Department of Botany, Field Museum; Professor, University of Illinois at Chicago.

B.Sc., Biology Academy, Bogor, Indonesia, 1962.
M.A., Biology, Harvard University, 1965.
Ph.D, Biology, Harvard University, 1969.

Head of Botany Section, University of Antioquia, Medellin, Colombia, 1969-1974.
Adjunct Associate Professor, Department of Pharmagonosy and Pharmacology, University of Illinois Medical Center, 1979-1983.
Associate Professor of Pharmacognosy, Department of Medicinal Chemistry and Pharmacognosy, University of Illinois Medical Center, 1983-present.
Professor of Pharmacognosy, 1989-present, University of Illinois at Chicago.

Plant systematics of Saurauia (Actinidiaceae); Field surveys for anti-Cancer and anti-AIDS drugs in southeastern Asia; Surveys for naturally occurring sweetening agents in plants; Ethnobotanical field studies in tropical forests.

Field studies in recent years have been in conjunction with National Cancer Institute sponsored programs searching for anti-Cancer and anti-AIDS compounds in plants, particularly in southeastern Asia. Current research includes the intensive sampling of a single forest test-site in order to estimate medicinal potential of rain forests in general. This work includes ethnobotanical work with indigenous people, precise plant-identification, and extensive literature review.

Systematic studies have focused on the taxonomy of the New World species of Saurauia, which includes trees that are an important component of evergreen forests, especially in cooler montane forest formations, and on the flora of Palawan (Philippines). The latter study is a contribution in the development of the resources of Palawan by the Government of the Philippines, for the well being of the people of Palawan and the Philippines in general.

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1982. Actinidiaceae. Pp. 1-48, In: G. Harling and B. Sparre (eds.), Flora of Ecuador, No. 17.

1984. Actinidiaceae. Pp. 1-25, In: A. Gomez-Pompa et al. (eds.), Flora de Veracruz (Mexico), fascicle 35.

1986. (with C. Gyllenhaal) Research on Colombian medicinal plants: roles and resources for plant taxonomists. Caldasia 15: 199-217.

1989. (with A. D. Kinghorn) Intensely sweet compounds of natural origin. Medical Research Review 9: 91-115.

1989. *Saurauia oroquensis*, a new Colombian species of Actinidiaceae. Brittonia 4: 28-31.

1991. (with C. Gyllenhaal, C. Lewandowski, and N. R. Farnsworth) Why do medical sciences need tropical rain forests? Transactions of the Illinois State Academy of Science 84: 65-76.

1991. Medicinal plants of Seberida (Riau Province, Sumatra, Indonesia). Journal of Ethnopharmacology 31: 217-237.

1993. Logistics and politics in plant drug discovery: the other end of the spectrum. Pp. 98-111, In: A. D. Kinghorn and M. F. Balandrin (eds.), Human Medicinal Agents from Plants, ASC Symposium Series, American Chemical Society, Washington DC.

CHARLES S. STANISH

Associate Curator, Middle and South American Archaeology and Ethnology and Chair, Department of Anthropology, Field Museum; Research Associate, Department of Anthropology, University of Chicago; Adjunct Professor, Department of Anthropology, University of Illinois at Chicago.

Ph.D., A.M., The University of Chicago, 1985.

Editorial Board Member, Prehistory Press, South America.
Vice President, Chicago Archaeological Society.

The archaeology of the Lake Titicaca Basin, South America; settlement archaeology; the evolution of agricultural systems; the evolution of complex political systems.

For the last 12 years, I have been studying the prehispanic civilizations of southern Peru and western Bolivia in the high southern Andes. My research began in a small valley in far southern Peru. My team and I discovered dozens of archaeological sites that dated from AD 900 to the Spanish Colonial Period. We specifically studied the ancient irrigation systems as they changed and collapsed over time. We learned that progressive drought and population increases ultimately caused the collapse of the agricultural system by the 15th century.

In 1987 I began a new project in the Titicaca Basin of southern Peru. The first settled villages in the Titicaca Basin began around 2000 BC. By 200 BC, archaic states controlled vast areas of agricultural land and built impressive irrigation systems. We have studied these societies paying special attention to the rise and fall of ancient agricultural systems. In the last five years, we have discovered almost 500 new sites.

This year, we began a project on the Island of the Sun, in the middle of Lake Titicaca in Bolivia. We surveyed the Island and discovered 130 archaeological sites. We will build a small research center on the island this summer, and continue archaeological survey and excavation on the Island.

Over the past several years, I have published a number of scientific papers and a book on my research in the southern Andes. Our research continues in Peru and Bolivia supported by the National Science Foundation. We plan to return every year to continue our study of the ancient civilizations of the Titicaca Basin.

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1989. Household Archaeology: Testing Models of Zonal Complementarily in the South Central Andes. American Anthropologist 91(1): 7-24.

1991. A Late Prehispanic Ceramic Chronology for the Upper Moquequa Sierra, Peru. Fieldiana, Anthropology, n.s. 16: 1-68.

1992. Ancient Andean Political Economy. Austin: University of Texas Press. 212 pp.

1993. (with E. de la Vega M. and K.L. Frye) Domestic Architecture of Lupaqa Area Sites. Pp. 1-12, In: M. Aldenderfer (ed.), Domestic Architecture in South Central Andean Prehistory. University of Iowa Press.

1993. (with M. Aldenderfer) Domestic Architecture, Household and the Past in the South-Central Andes. Pp. 83-94, In: M. Aldenderfer (ed.), Domestic Architecture in South Central Andean Prehistory. University of Iowa Press.

1994. The Hydraulic Hypothesis Revisited: A Theoretical Perspective on Lake Titicaca Basin Raised Field Agriculture. Latin American Antiquity v. 5(3).

1994. (with L.H. Steadman) Archaeological Research at the Site of Tumatumani, Juli, Peru. Fieldiana, Anthropology, n.s. 23.

DOUGLAS F. STOTZ

Conservation Ecologist, Environmental and Conservation Programs, Field Museum.

B.S., Biology, University of Arizona, 1978.
Ph.D., Evolutionary Biology, University of Chicago, 1990.

Avian evolutionary biology, diversity and endemism in the Neotropics, avian community ecology, ecomorphology, conservation biology.

My main research interest focuses on understanding the causes and consequences of the extremely high diversity of birds in Neotropical forests. I have considered two basic issues: (a) How is diversity maintained ecologically? and (b) How does the morphology of a species relate to its ecological role? The high species diversity within tropical genera and families makes these ideal for studying the interface between ecology, behavior, and morphology. The diverse communities in the tropics provide greater opportunity for intense species interactions, which are then easily studied. On a broader scale, I am interested in the ecological basis for geographic patterns of species diversity and endemism, especially as this relates to differences in the major biogeographic units of humid forest. My current focus is on documenting and understanding the patterns of avian diversity and endemism along elevational gradients in Central and South America.

My interest in diversity feeds directly into my concern with conservation biology. Biological data can be used much more effectively in developing conservation strategies in the Neotropics. The information on the distribution, ecology and taxonomy of birds is the most accurate and detailed available for any taxonomic group. These datacan be used to help guide decision-making and planning for Neotropical conservation. I have recently completed a book, with three colleagues, that analyses avian distribution and ecological patterns to set priorities for conservation action in the Neotropics. I will continue to focus on developing biological data relevant to conservation in the Neotropics, and ensuring that these data are used.

* * *

1989. (with R. O. Bierregaard) The birds of the Fazendas Esteio, Porto Alegre, and Dimona, Amazonas, Brasil. Revista Brasileira de Biologia 49:861-872.

1990. (with S. M. Lanyon and D. E. Willard) *Clytoctantes atrogularis*, a new species of antbird from Brazil. Wilson Bulletin 102: 571-580.

1992. (with R. O. Bierregaard, M. Cohn-Haft, J. Smith, P. Petermann, A. Whittaker and S. Wilson) The status of North American migrants in central Amazonian Brazil. Condor 94:608-621.

1992. Specific status and nomenclature of *Hemitriccus minimus* and *Hemitriccus aenigma*. Auk 109: 916-917.

1993. A hybrid manakin (*Pipra)* from Roraima, Brazil, and a phylogenetic perspective on hybridization in Pipridae. Wilson Bulletin 105: 348-351.

1993. Geographic variation in species composition of mixed species flocks in lowland humid tropical forests of Brazil. Papeis Avulsos de Zoologia, São Paulo 38:61-75.

(in press) (with J. W. Fitzpatrick, T. A. Parker III, and D. K. Moskovits) Neotropical Birds: Ecology and Conservation. University of Chicago Press, Chicago, IL.

JOHN TERRELL

Curator of Oceanic Archaeology and Ethnology, Department of Anthropology, Field Museum; Adjunct Professor of Anthropology, Northwestern University; Visiting Professor, University of Illinois at Chicago

A. B. *magna cum laude* with Highest Honors in Anthropology, Harvard College, 1964
A.M., Harvard University, 1968
Ph.D., Harvard University, 1976

1993-1995 Board of Directors, Council for Museum Anthropology
1992 Morton H. Fried Prize, American Anthropological Association (shared with R. L. Welsch and J. Nadolski)

The anthropology and prehistory of the Pacific Islands; ecological and biogeographical approaches in the social sciences; history and theory of science; epistemology

In 1995 John Terrell and Dr. Robert L. Welsch Adjunct Associate Curator of Anthropology, recruited an impressive number of research colleagues to begin expanding Field Museum's New Guinea Research Program (NGRP) in a new strategic direction. Dr. Pamela Stewart, Research Associate, Department of Anthropology, joined Terrell and Welsch to develop The Health and Human Biogeography Project. Working with them are Dr. Jeremy Martinson, Molecular Biology Unit, Oxford University, and Dr. Kevin M. Kelly, Department of Clinical Research, Dallas Hospital. This initiative will explore the biological diversity and population structure of the "community of culture" on the Sepik coast of New Guinea first identified by Welsch and Terrell on the basis of their intensive study of the Museum's renowned New Guinea collections. Also in 1995 we were awarded another National Science Foundation research grant to continue our archaeological invesitigations on the Sepik coast as part of NGRP's Ancient Voyagers Project, which is a collaborative undertaking with Dr. Robin Torrence, Research Associate, Department of Anthropology, and Australian Research Fellow, Australian Museum (Sydney), and Glenn Summerhayes, Research Scholar, LaTrobe University (Melbourne). With seed funding from the Museum's Center for Cultural Understanding and Change, Kelly Nelson, a graduate student in anthropology at Brandeis University, carried out pilot research in Chicago during the summer months for The Collaborative Kinship and Adoption Project (CKAP), a joint undertaking with Laura Litten (Columbia College), Research Associate in Anthropology. CKAP is documenting kinship, adoption, and families around the world.

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1995. "Predicting similarity in material culture among New Guinea villages from propinquity and language," by J.M. Roberts, Jr., C.C. Moore, and A.K. Romney. Current Anthropology 36:780.

1994. Ruatepupuke. A Maori Meeting House (with Arapata Hakiwai). Chicago: Field Museum Press.

1994. Anthropology and Adoption (with Judith Modell). American Anthropologist 96:155-61.

1994. Reply to Moore and Romney (with R.L. Welsch). American Anthropologist 96:392-96.

MARGARET K. THAYER

Adjunct Assistant Curator, Insects, Department of Zoology, Field Museum.

Sc.B., Biology, Brown University, 1973.
Ph.D., Biology, Harvard University, 1985.

Visiting Assistant Curator, Field Museum, 1988-1992.
Advisory Panel, Biotic survey and Inventory Program, National Science Foundation, 1991, 1994.
Editorial Board, Annals of the Entomological Society of America (Chair 1994).
International Editorial Board, Annales Zoologici.
President-Elect, Coleopterists Society (President 1995-1996).
Treasurer, Coleopterists Society, 1987-1991.

Systematics, biology, and evolution of world Staphylinidae (especially Omaliinae); Historical biogeography, especially of austral regions; Faunistic studies of southern hemisphere temperate Staphyliniformia.

Research has focused on the systematics, evolution, and biogeography of basal elements of the large and ancient beetle family Staphylinidae (rove beetles). Many of these lineages are restricted to either northern or southern temperate areas of the world. A major work in progress on the 40+ genera of the tribe Omaliini will begin to make that worldwide, mainly temperate-zone, group accessible for phylogenetic and large-scale historical biogeographic studies.

Taxonomically broader fieldwork-based faunistic work on the southern continents, presently concentrating on Australia, is another part of my research program, in collaboration with A. F. Newton. The staphyliniform faunas of Australia, New Zealand, Chile, and South Africa are highly endemic at the specific level, but strongly interconnected at generic and higher levels. This work is expanding knowledge of the diversity, distribution, and biology of the Staphyliniformia of those regions and also, in the long term, knowledge of apparently ancient biogeographic relationships among the regions.

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1979. (with A. F. Newton, Jr.) Revision of the south temperate genus *Glypholoma* Jeannel, with four new species (Coleoptera: Staphylinidae: Omaliinae). Psyche 85: 25-63.

1985. The larva of *Brathinus nitidus* LeConte and the systematic position of the genus (Coleoptera: Staphylinidae). Coleopterists Bulletin 39(2): 174-184.

1985. Revision, phylogeny, and biogeography of the austral genus *Metacorneolabium* Steel (Coleoptera: Staphylinidae, Omaliinae). Pp. 113-179 In: G. E. Ball, (ed.), Taxonomy, phylogeny, and zoogeography of beetles and ants. A volume dedicated to the memory of Philip Jackson Darlington, Jr. 1904-1983. Series Entomologica 33, Dr. W. Junk Publishers, Dordrecht.

1987. Biology and phylogenetic relationships of *Neophonus bruchi*, an anomalous south Andean staphylinid (Coleoptera). Systematic Entomology 12: 389-404.

1992. (with A. F. Newton, Jr.) Current classification and family-group names in Staphyliniformia (Coleoptera). Fieldiana: Zoology, n. s.. 67: 1- 92.

1992. Discovery of sexual wing dimorphism in Staphylinidae (Coleoptera): *"Omalium" flavidum*, and a discussion of wing dimorphism in insects. Journal of the New York Entomological Society 100(4): 540-573.

WILLIAM D. TURNBULL

Curator Emeritus, Fossil Mammals, Department of Geology, Field Museum ; Lecturer, Committee on Evolutionary Biology, University of Chicago; Research Associate, University of Texas (Texas Memorial Museum).

Ph.D.,University of Chicago, 1967.

Bibliographic compiler for Saugetierkundliche Mitteilungen from 1955-65.
Vice-president and President of the Society of Vertebrate Paleontology, 1976-1977, 1977-1978.
Co-leader, two expeditions to Australia (1963-4), (1966-7), (1976-7) and leader of many field trips into the Washakie Basin of Wyoming (1956-93).

Mammalian systematics, evolution, ecology and zoogeography, especially North American Eocene and Mesozoic faunas, Australian Tertiary and Pleistocene faunas; functional morphology of mammalian masticatory apparatus; paleopathology; taphonomy; basicranial anatomy of marsupials; group origins and replacements.

Current research involves (i) the mammalian fauna of the Washakie Formation (southwest Wyoming) and the stratigraphic sequence of the deposits of the formation (uintatheres, marsupials and perissodactyls, and several other works in progress), (ii) Late Tertiary and Pleistocene mammalian faunae of Australia, (iii) functional anatomy and restoration of the masticatory musculature of the Eocene taeniodont, *Stylinodon*,, and iv) the multituberculates of the Early Cretaceous (Trinity Group) of north Texas.

* * *

1991. *Protoptychus hatcheri* Scott, 1895: the mammalian faunas of the Washakie Formation, Eocene Age, of southern Wyoming. Part II. The Adobetown Member, middle division (=Washakie B), TWKa/2 (in part). Fieldiana: Geology, n.s. 21: 1-33.

1992. (with B. Patterson, W. Segall and T. Gaudin) The ear region in Xenarthrans (Edentata: Mammalia). Part II. Pilosa: sloths, anteaters, paleanodonts and a miscellany. Fieldiana: Geology, n.s. 24: 1-79.

1993. (with E. L. Lundelius, Jr. and R. H. Tedford) Plio-Pleistocene mammalian fauna at Smeaton, Victoria. Pp. 429-440. In: P. A. Jell (ed.). Ken Campbell Festschrift, Association of Australian Paleontologists, Brisbane.

1995 (with R. Richards) Giant short-faced bear (*Arctodus simus yukonensis*). Remarks from Fulton County, northern Indiana. Fieldiana: Geology N.S. 30: i-iii, 1-34.

1995. The problem of the uintathere molars (once more). Pp. 261-265. In: R. J. Radlonski and H. Renz (eds.), Proc. 10th Int. Symposium on Dental Morphology. Berlin.

1995. Trinity mammal jaws from the Early Cretaceous of North Texas. Pp. 266-270. In: R. J. Radlonski and H. Renz (eds.), Proc. 10th Int. Symposium on Dental Morphology. Berlin.

1995 (with T. J. Gaudin, J. R. Wibel and J. A. Hopson) Reexamination of the evidence for the cohort epitheria (Mammalia: Eutheria). J. Mamm. Evol. 3(1): 31-79 (has 1996 date).

1996. (in press) (with S. M. McCarroll and J. J. Flynn) A review of the biostratigraphic and magnetic polarity correlations of the Washakie Formation, Washakie Basin, Wyoming. In: D. R. Prothero (ed.), The Terrestrial Eocene-Oligocene Transition in North America. Cambridge Univ. Press (40 ms. pp.)

1996. (in press) (with R. Richards and C. S. Churcher) Distribution and size variation in North American short-faced bears, *Arctodus simus*. In: Churcher Festschrift volume. Royal Ontario Museum Publications in Life Sciences (100 ms. pp.)

JANET R. VOIGHT

Assistant Curator, Invertebrates, Department of Zoology, Field Museum; Lecturer, Committee on EvolutionaryBiology, University of Chicago.

B.S., Biology, Iowa State University, 1977.
Ph. D., Ecology and Evolutionary Biology, University of Arizona, 1990.

Ecology and evolution of cephalopod molluscs, Life History variation; reproductive biology; marine biogeography.

My research focuses on cephalopod mollusks, squids, octopuses and cuttlefishes, cosmopolitan marine animals. Study of cephalopods offers to reveal patterns of biogeographical relationships among oceanic areas and how evolution has allowed these animals to exploit all ocean depths. Quantitative analysis and anatomical studies are proving to be important tools for understanding how these animals live in the deep sea and how they have evolved to occupy what to us is the least desirable habitat on earth. Reproductive biology of these animals, given their apparent low densities and short life spans is another area of interest. In addition to furthering our understanding of cephalopod biology, and perhaps to understand why virtually all members of the group die after a single reproductive episode, my research program aims to produce a better understanding of the diversification of marine animals through time and space.

* * *

1991. Ligula length and courtship in *Octopus digueti:* A potential mechanism of mate choice. Evolution 45: 1726-1730.

1991. Enlarged suckers as an indicator of male maturity in *Octopus.* Bulletin of Marine Science 49: 98-106.

1991. Morphological Variation in Octopod specimens: Reassessing the assumption of preservation-induced deformation. Malacologia 33: 241-253.

1992. Movement, injuries and growth of members of a natural population of the Pacific pygmy octopus, *Octopus digueti.* Journal of Zoology London Society 228: 247-263.

1993. The association between distribution and octopodid morphology: Implications for classification. The Zoological Journal of the Linnean Society 108: 209-223.

1993. The arrangement of suckers on octopodid arms as a continuous character. Malacologia 35: 351-359.

1993. A Cladistic Reassessment of Octopodid subfamilies. Malacologia 35: 343-349.

1994. Close encounter in the deep. Nature 371: 563. (with R. A. Lutz).

1994. Morphological variation in shallow-water octopuses (Mollusca: Cephalopoda). Journal of Zoology, London. 232: 491-504.

HAROLD K. VORIS

Curator and Head, Amphibians and Reptiles, Department of Zoology, Field Museum; Lecturer, Committee on Evolutionary Biology, University of Chicago.

B.A., Biology, Hanover College, 1962.
Ph.D., Biology Department, University of Chicago, 1969.

Hanover College Alumni Achievement Award, 1983.

Ecology and systematics of marine snakes/coevolution of pedunculate barnacles and decapod crustaceans/comparisons of old-world tropical rain forest amphibian and reptile communities.

In the lowland tropical rain forests of Borneo, Bob Inger and I are studying the natural changes in communities of amphibians and reptiles that occur over time, and differences that occur from place to place. Last year comparisons between logged forests and undisturbed forests added another dimension to the comparisons, and this year we are applying our findings to the issue of world-wide declining amphibian populations.

In the Pulau Tiga marine park off the north coast of Borneo, Rob Stuebing and I, along with several Malaysian students, are exploring the ecology of the banded sea krait, an amphibious sea snake. Our research has focused on how these snakes budget their activities between the land and the sea near the equator. At the core of this work is a five–year mark–and–recapture program that has provided us with detailed information on the numbers of snakes and structure of the population as well as the growth rates of individual snakes. One of our long–range objectives is to investigate the plasticity in important life history traits over the species' huge geographic range that straddles the equator from New Caledonia to the Bay of Bengal.

In the straits of Johore between Malaysia and Singapore and in Thailand we are trying to understand the degree to which coevolution has occurred in a symbiotic relationship that exists between pedunculate barnacles, on the one hand, and crabs and snakes on the other. Recently our work on the mechanisms of colonization of the edible crab by barnacles was completed and we are now looking at colonization patterns and the effect of these patterns on survivorship.

* * *

1989. (with W. B. Jeffries and C. M. Yang) A new mechanism of host colonization: pedunculate barnacles of the genus *Octolasmis* on the mangrove crab, *Scylla serrata*. Ophelia 31(1): 51–58.

1991. (with E. A. Lading and R. B. Stuebing) A population size estimate of the yellow–lipped sea krait, *Laticauda colubrina*, on Kalampunian Damit island, Sabah, Malaysia. Copeia (4): 1139–1142.

1994. (with R. F. Inger) A comparison of amphibian communities through time and from place to place in Bornean forests. Journal of Tropical Ecology 9:409–433.

1994. (with W. B. Jeffries and S. Poovachiranon) Patterns of distribution of two barnacle species on the mangrove crab, *Scylla serrata*. Biological Bulletin 187: 346–354.

(in press) (with R. F. Inger) Are frogs declining in abundance along streams in Bornean rain forests? Conservation Biology

MEENAKSHI WADHWA

Assistant Curator, Meteoritics and Mineralogy, Department of Geology, Field Museum; Visiting Scholar, University of Chicago

B.S., Geology, Panjab University, 1988
M.S., Geology, Panjab University, 1989
Ph.D., Earth and Planetary Sciences, Washington University, 1994

Member, Meteorite Nomenclature Committee
Member, Meteorite Working Group

Processes and time scales involved in the formation histories of meteorites from trace element and isotopic studies.

I am interested in a variety of meteorite groups, ranging from primitive ones (among them, enstatite chondrites, eucrites and mesosiderites) to some of the youngest known meteorites (i.e., the SNC or "martian" meteorites). The focus of my research on these widely diverse objects has been two-fold, (1) to decipher the processes involved in their formation using trace element (particularly, rare earth element) distributions in their minerals, and (2) to determine their time scales of formation using long lived (Samarium-Neodymium and Rubidium-Strontium) and short lived (Manganese-Chromium) chronometers. The goals of my research program, through the studies mentioned above, are to gain a better understanding of meteorite formation events in the solar system, and in particular, to resolve the chronology of such events in early solar system history.

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1993. (with B. L. Jolliff, L. A. Haskin, and R. O. Colson) Partitioning of REE-saturating minerals: Theory, experiment, and modelling of whitlockite, apatite, and evolution of lunar residual magmas. Geochimica et Cosmochimica Acta 57: 4069-4094.

1993. (with R. P. Harvey, H. Y. McSween, Jr., and G. Crozaz) Petrography, mineral chemistry, and petrogenesis of Antarctic shergottite LEW88516, Geochimica et Cosmochimica Acta 57: 4769-4783.

1994. (with H. Y. McSween, Jr., and G. Crozaz) Petrogenesis of shergottite meteorites inferred from trace and minor element microdistributions. Geochimica et Cosmochimica Acta 58: 4213-4229.

1995. (with G. Crozaz) Trace and minor elements in minerals in nakhlites and Chassigny: clues to their petrogenesis. Geochimica et Cosmochimica Acta 59: 3629-3645.

PETER J. WAGNER

Assistant Curator, Department of Geology, Field Museum.

B.S., Anthropology / Zoology, University of Michigan, 1986.
B.S., Geology, Michigan State University, 1988.
M.S., Geology, Michigan State University, 1990.
Ph.D., Geophysical Sciences, University of Chicago, 1995.

Paleozoic molluscan systematics / macroevolution

My research focuses on morphologic and phylogenetic diversification, concentrating primarily on Paleozoic gastropods and rostroconchs (an extinct group thought to be related to bivalves and scaphopods). Estimates of the phylogenetic relationships among species form the bases for most of my studies. These estimates then are integrated with other data, such as multivariate measurements of morphologies, which permits testing of many types of macroevolutionary hypotheses. Studies that I have conducted to date include i) testing for increasing constraints on morphologic evolution; ii) delimiting the underlying patterns of long-term evolutionary trends; and iii) exploring the relationships between morphology and rates of speciation and/or extinction. More recent work has used anatomical data from extant gastropods to test predictions made by the results of the paleontological studies. In addition to research focusing on specific macroevolutionary questions, I also have worked on some methodological aspects of phylogenetic analyses. Such projects include: i) contrasting the predictions of parsimony with the observed fossil record; ii) using computer simulations to delimit the circumstances under which different methods for estimating phylogenies (i.e., strict parsimony and methods that utilize stratigraphic data in different manners) should be most effective; iii) using both real data and computer simulations to explore how different phylogenetic methods might suggest different patterns of morphologic and phylogenetic diversification; and iv) contrasting the implications of tests based on estimated phylogenies with the results of tests using non-phylogenetic methods.

I am interested in collaborating with researchers studying: i) general macroevolutionary questions, especially from phylogenetic and/or morphometric perspectives; ii) aspects of the early Paleozoic radiations of marine invertebrates; iii) the systematics and evolutionary history of molluscs, especially (but not exclusively) gastropods and Paleozoic taxa; and iv) general methodological issues pertaining to phylogenetic and comparative biological research.

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1995. Stratigraphic tests of cladistic hypotheses. Paleobiology 21:157 - 175.

1995. Testing evolutionary constraint hypotheses: examples with early Paleozoic gastropods. Paleobiology 21:248 - 272.

1995. Diversification among early gastropods: contrasting taxonomic and phylogenetic data. Paleobiology 21:410 - 439

1995. (with D. H. Erwin) Phylogenetic tests of speciation hypotheses. Pp. 87-122 In: D.H. Erwin and R.A. Anstey, eds. New Approaches to Studying Speciation in the Fossil Record. Columbia University Press, New York.

1996. Contrasting the underlying patterns of active trends in morphologic evolution. Evolution 50 (in press).

ALAKA WALI

Associate Curator, Circum-Caribbean and Central America, Anthropology Department, Field Museum and Director, Center for Cultural Understanding and Change; Senior Ethnographer, Harlem Birth Right Project of the New York Urban League.

B.A., Radcliffe College (Harvard University), 1974
Ph.D., Columbia University, 1984

Impact of economic and social change on social organization and cultural identity.

I joined the Museum as Director of the Center for Cultural Understanding and Change and Visiting Associate Curator in October of 1994. My research program has concentrated on understanding the impact of global economic restructuring on the ways in which people organize themselves and constitute their social identities. As an applied anthropologist, my aim has been to use the results of the research to formulate more humane solutions to social problems. This research has taken place in two different sites: Central and South American "hinterlands" and urban areas in the United States. In the Central and South American context, I researched the ways in which indigenous people have confronted massive disruption to their use of land and resources as a result of national development schemes. In the urban United States, I have researched the obstacles to resource acquisition for economically disadvantaged groups and the ways in which local social organization forms and cultural strategies can be incorporated into grass-roots empowerment programs.

At The Field Museum, I hope to extend my urban research in the Chicago area. As Director of the CCUC I hope to expand efforts in the anthropology department to create local links in Chicago on research and public education programs, work closely with public programs and education on new exhibits, and work closely with the Center for Evolutionary and Environmental Biology to foster interdisciplinary approaches to the understanding of the human-environment interface.

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1989. Kilowatts and Crisis: Hydroelectric Power and Social Dislocation in Eastern Panama. Westview Press, Boulder Colorado.

1990. Living with the Land. Ethnicity and Development in Chile. Grassroots Development, (14:2), Journal of the Inter-American Foundation, Arlington, VA.

1990. When Planning Fails: Unanticipated Consequences of Resettlement in Eastern Panama. Practicing Anthropology. (12:3), Society for Applied Anthropology, Oklahoma City, OK.

1992. Multiculturalism: An Anthropological Perspective. Report from the Institute for Philosophy and Public Policy. (12:1), University of Maryland, College Park.

1992. (with M. Jenakovich, K. Fraser and L. Samberg). I Wish: Stories of Children Growing Up in Washington, D.C. National Association of State Boards of Education Monograph, Arlington, VA.

1993. (with S. Davis) Indigenous Territories and Tropical Forest Management in Latin America. Monograph of the Environment Department, The World Bank, Washington, D.C.

1993. The Transformation of a Frontier: State and Regional Relationships in Panama, 1972-1990. Human Organization (52: 2).

1994. (with S. Davis) Indigenous Land Tenure and tropical Forest Management in Latin America. Ambio, Journal of the Royal Swedish Academy of Sciences, (23:8).

1995. La política de desarrollo y las relaciones entre Región y Estado: el Caso del Oriente de Panamá, 1972-1990. Mesoamérica, Publicacion del Centro de Invesitgaciones Reionales de Mesoamérica y Plumsock Mesoamerican Studies, (16)29: 125-158.

ROBERT L. WELSCH

Adjunct Curator, Department of Anthropology, The Field Museum; Visiting Associate Professor, Department of Anthropology, Dartmouth College; Visiting Curator, The Hood Museum of Art, Dartmouth College

B.A., Northwestern University, 1972.
M.A., University of Washington, 1976.
Ph.D., University of Washington, 1982.

The anthropology and material culture of Papua New Guinea.

This year, I continued my research on friendship and society along the Sepik Coast of New Guinea as part of the A. B. Lewis Project, a collaborative research project begun in 1987, that involves staff from The Field Museum, the Papua New Guinea National Museum and Art Gallery, and the University of Papua New Guinea. My efforts this year included cataloging the collection made during the 1993-94 field season, including more than 2000 ethnological specimens, which were divided between the National Museum and The Field Museum. This project is focused on the nature and processes of regional integration along one of the world's most linguistically diverse areas, which nevertheless form a common community of culture. This community of culture is based on inherited friendships and periodic generosity and gifts between friends. My manuscript on A. B. Lewis, his field diaries, and his collection has been copy-edited by the University of Hawaii Press, and is scheduled for a fall 1996 release date. I also began research on art of the Papuan Gulf, which has included visits to numerous museums around the country to study collections. Although the project is specifically intended to upgrade documentation and cataloging of the Hood Museum's collection, it also is aimed at an exhibition in 1999.

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1985. The Distribution of Therapeutic Knowledge in Ningerum: Implications for Primary Health Care and the Use of Aid Posts. Papua New Guinea Medical Journal 28: 67-72.

1986. Primary Health Care and Local Self-Determination: Policy Implications from Rural Papua New Guinea. Human Organization 45(2): 103-112.

1987. Multinational Development and Customary Land Tenure: The Ok Tedi Project of Papua New Guinea. The Journal of Anthropology 6(2): 109-132.

1988. (with A. F. Afdhal) The Rise of the Modern Jamu Industry in Indonesia: A Preliminary Overview. Pp. 149-172, In: S. van der Geest and S.R. White (eds.), The Context of Medicines in Developing Countries: Studies in Pharmaceutical Anthropology. Dordrecht: Kluwer Academic Publishers.

1990. (with J. Terrell) Trade Networks, Areal Integration, and Diversity along the North Coast of New Guinea. Asian Perspectives 29: 156-165.

1991. Traditional Medicine and Western Medical Options among the Ningerum of Papua New Guinea. Pp. 32-55. .In: L. Romanucci-Ross, D. Moerman and L. Tancredi (eds.), The Anthropology of Medicine: From Culture to Method.

1991. (with J. Terrell) Continuity and Change in Economic Relations Along the Aitape Coast of Papua New Guinea, 1909-1990. Pacific Studies 14(4): 113-128.

1992. (with J. Terrell and J.A. Nadolski) Language and Culture on the North Coast of New Guinea. American Anthropologist 94(3): 568-600.

1993. Captain Cook's Voyages of Discovery, Originally compiled by John Barrow, and published in 1860, with a new introduction by Robert L. Welsch. Chicago: Academy Chicago.

1994. Pig Feasts and Expanding Networks of Culutural Influence in the Upper Fly-Digul Plain. Pp. 85-119. In: A. J. Strathern and G. Stürtzenhofecker (eds.), Migrations and Transformations: Regional Perspectives in New Guinea Pittsburgh: University of Pittsburgh Press.

1994. (with J. Terrell) Reply to Moore and Romney. American Anthropologist 96: 392-396.

MARK W. WESTNEAT

Assistant Curator and Head, Fishes, Department of Zoology, Field Museum.

B.A., Biology, The College of Wooster, 1984.
Ph.D., Zoology, Duke University, 1990.

D. Dwight Davis Award, American Society of Zoologists, 1990.
Raney Award in Ichthyology, American Society of Ichthyologists and Herpetologists, 1988.
Nomination by American Association of Museums for NSF's Alan T. Waterman Award, 1993.

Functional morphology of vertebrates, with emphasis on behavioral kinetics and muscle physiology during feeding and locomotion.

Current studies address the integration of phylogenetic systematics with comparative biomechanics and functional morphology. My research goals in systematics include the resolution of relationships among species and higher level taxa in the fishes of the tropical, marine family Labridae (the wrasses). Character analysis of labrid fishes to date has followed a traditional morphological focus, but data are now being sought from color patterns, behavior, function, and perhaps molecules in an attempt to establish a broad character data base to aid tree construction among the 600 labrid species. The functional morphology of feeding and locomotion in living fishes is being studied by high speed film and video analysis of behavior. Using comparative anatomy, theory from mechanical engineering, and new image and motion analysis techniques, the musculoskeletal mechanisms of feeding and swimming are being described in fishes of the Labridae, Carangidae, and Scombridae. The goal is to document the mechanisms of force transfer from muscle through connective tissue to skeleton in feeding and locomotor systems. Combined with a phylogenetic hypothesis, this research program tries to clarify the patterns of evolution of functional systems in fishes.

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1990. Feeding mechanics of teleost fishes (Labridae: Perciformes): A test of four-bar linkage models. Journal of Morphology 205: 269-295.

1991. Linkage biomechanics and evolution of the jaw protrusion mechanism of the sling-jaw wrasse, *Epibulus insidiator*. Journal of Experimental Biology 159: 165-184.

1993. (with W. Hoese, C. A. Pell, and S. A. Wainwright) The horizontal septum: mechanisms of force transfer in the locomotion of scombrid fishes (Scombridae, Perciformes). Journal of Morphology 217: 183-204.

1993. (with J. H. Long, B. Hoese and S. Nowicki) Kinematics of birdsong in sparrows: functional correlates of beak and head motion. Journal of Experimental Biology 182: 147-171.

1993. A phylogenetic hypothesis for the tribe Cheilinini (Labridae: Perciformes. In: Proceedings of the ASIH symposium on Percomorph phylogeny, D. Johnson (ed.). Bulletin of Marine Science 52: 351-394.

1994. Transmission of force and velocity in the feeding mechanisms of labrid fishes. Zoomorphology 114: 103-118.

(in press) Systematics and biomechanics in ecomorphology. In: Luczkovich, J., Motta, P., and S. Norton, eds. Symposium on the ecomorphology of fishes Environmental Biology of Fishes.

(in press) Feeding, function, and phylogeny: Analysis of historical biomechanics in labrid fishes using comparative methods. Systematic Biology.